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JANUARY TO JUNE, 1952

Vol. 74 Parts 1 to 6

QUEENSLAND AGRICULTURAL JOURNAL

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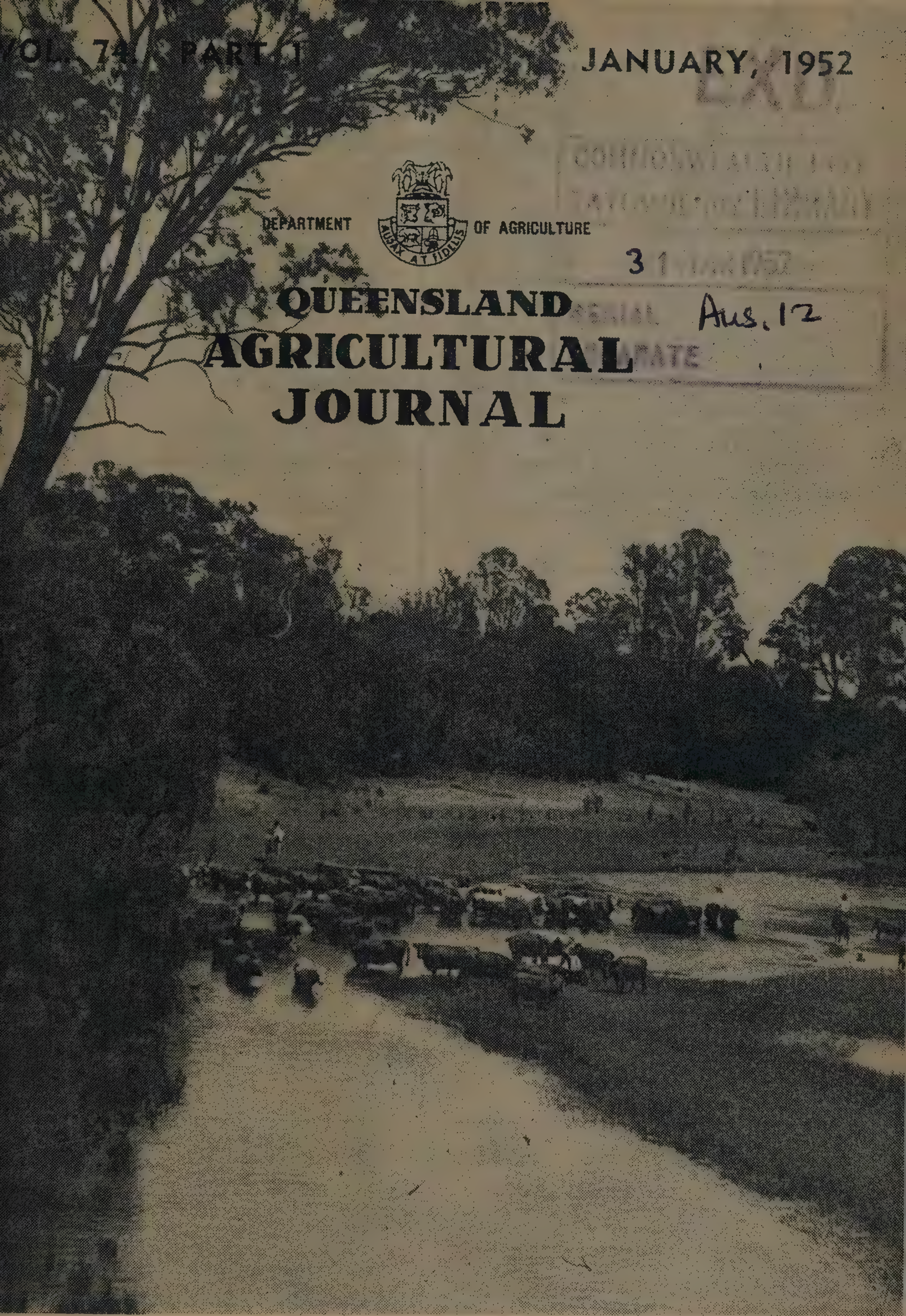

Cattle Crossing the Brisbane River near Fernvale.

LEADING FEATURES

Agriculture in Beaudesert Area

The Apple

Dairy Equipment Competition

Potato Tuber Moth

Registered Veterinary Medicines

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C. W. WINDERS, B.Sc.Agr.

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Agriculture in the Beaudesert District.

W. J. WHITE, Adviser in Agriculture.

LAND in the vicinity of the town now known as Beaudesert was taken up about the year 1840 by Edwin Hawkins, who came from Bathurst, New South Wales, bringing with him a large herd of cattle. He named the station property Beaudesert, after his home, Beaudesert, on the Trent River, Staffordshire, England. This property eventually passed into the hands of William Duckett White, who subdivided it into areas of 2,000 to 2,500 acres.

It is of interest to note that Sea Island cotton was introduced into the district during 1863 by Captain Robert Towns. The homestead known as Townsvale was built at a point about two miles from the present Gleneagle railway station. In 1865 the plantation came under the management of Mr. W. T. Walker, the partner of Captain Towns.

Plate 1.
"Townsvale" Homestead, one of the Historic Homes of the Beaudesert District.

Approximately 500 acres were cultivated for cotton crops and the labour force to work this area included 200 kanakas. Cotton gins were erected on the plantation and the lint after baling was hauled to Brisbane by bullock dray and then shipped to England.

Settlement at Beaudesert followed the pattern which is typical of many other agricultural districts in Queensland. Stock raising predominated in the early days but with closer settlement cultivation of the land was expanded and intensified on smaller holdings. Dairying, pig and beef cattle raising and the production of crops such as lucerne, maize and pumpkins are all important primary industries in the present economy of the area.

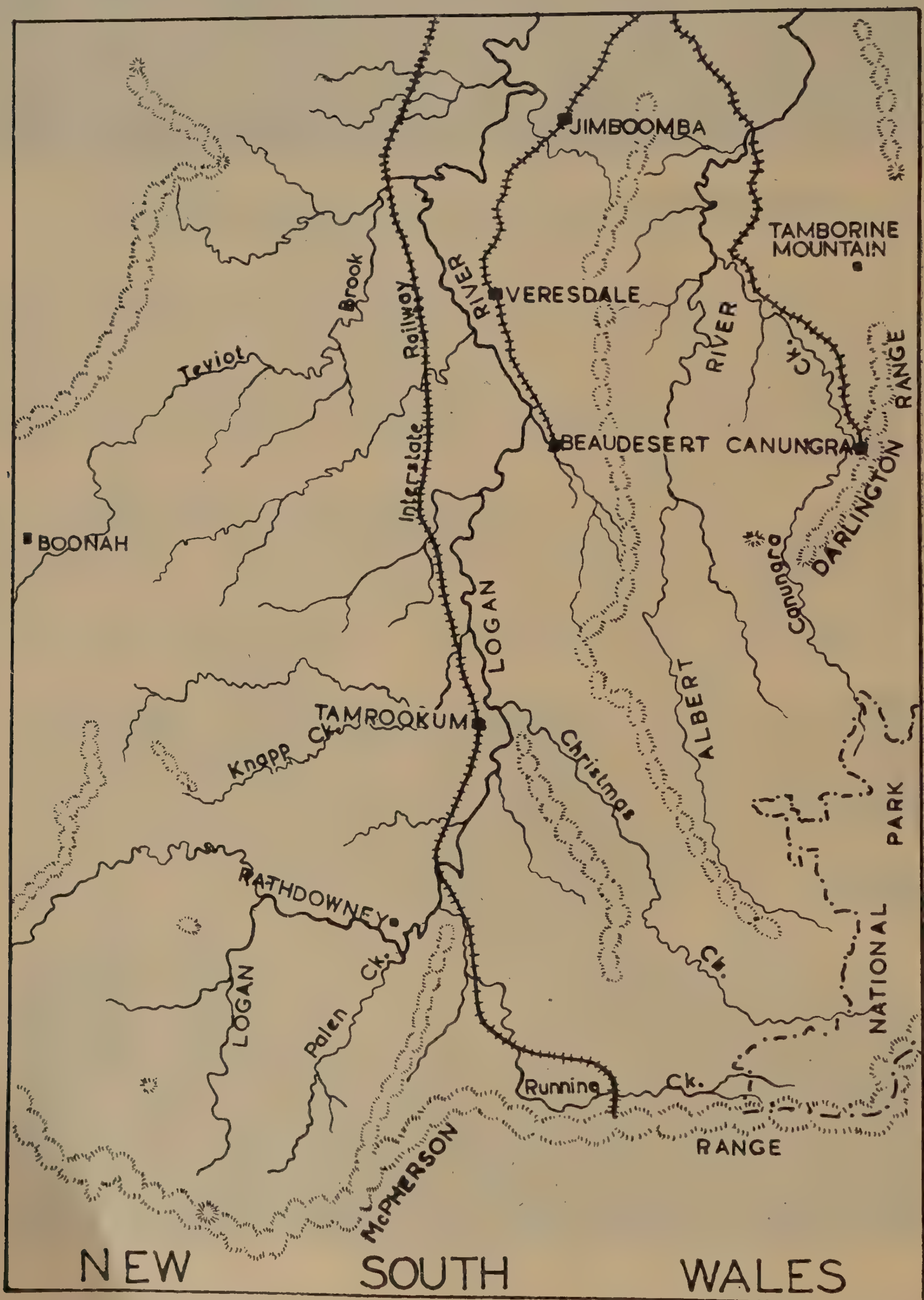

Plate 2.

Sketch Map of the Beaudesert District.

The Beaudesert district is accepted as the area extending from Jimboomba to the Queensland–New South Wales border and from Tamborine to the boundaries of the Boonah district, enclosing an area of approximately 740,000 acres. Considerable development has already taken place but it seems certain that in the future much land which still remains under native pastures will be ploughed and brought under intensive cultivation, thus increasing production from the area.

CLIMATE.

The climate is reasonably pleasant, though very hot humid periods do occur in the summer and some severe frosts may be experienced in the winter. The average rainfall is about 40 inches per annum and is mainly concentrated in the period October to March, varying from an average of about three inches in November to seven inches in January and February.

The expectation of good rain in the months December to February is high, but the spring rains are erratic. Winter rains are unreliable but in a number of years good falls are registered in June. As would be expected, summer growing crops are more important than winter crops. Nevertheless, excellent results are often obtained with the latter.

Rainfall data for Beaudesert for the years 1941 to 1950 inclusive are shown in Table 1.

TABLE 1.

RAINFALL AT BEAUDESERT, 1941–1950 (IN POINTS).

Month.	1941.	1942.	1943.	1944.	1945.	1946.	1947.	1948.	1949.	1950.	Av. (in.)
Jan. ..	1,158	250	522	637	373	1,197	1,575	326	282	414	6·73
Feb. ..	224	907	256	374	1,085	742	542	240	1,411	984	6·76
Mar. ..	454	293	103	94	145	472	1,159	284	687	551	4·24
Apr. ..	201	110	129	16	111	265	296	260	48	203	1·74
May ..	108	182	71	239	258	14	131	710	69	38	1·82
June..	142	143	130	62	1,114	14	50	803	324	658	3·44
July ..	34	180	18	249	288	10	20	100	190	870	1·78
Aug. ..	30	157	135	192	131	29	47	69	43	18	·85
Sept...	69	58	241	184	134	342	247	348	118	24	1·76
Oct. ..	17	708	541	107	162	201	208	..	835	574	3·35
Nov...	74	437	510	145	436	173	331	227	378	529	3·24
Dec. ..	248	1,259	868	231	279	430	979	357	368	125	5·14
	2,759	4,684	3,524	2,530	4,516	3,889	5,585	3,724	4,672	4,988	

Average rainfall for 10 years—40·87 inches.

SOILS AND VEGETATION.

The soils can be broadly classified into four main groups:—(1) alluvial soils, (2) soils of the lower slopes, (3) soils of the softwood scrub areas, and (4) soils of the ridges.

Alluvial Soils.

The original vegetation of these soils was open forest with grass, the main trees being large blue gum (*Eucalyptus tereticornis*) and apple (*Angophora* sp.). These soils, which cover extensive areas in places, occur on flats bordering the Logan River, the Albert River and all the main and auxiliary creeks. They comprise deep loams and clay loams to clays, mostly dark grey-brown in colour, and of very good structure and high fertility.

Excellent crops of lucerne, maize, pumpkins, potatoes and fodder crops can be grown on them and for the most part applications of fertilizer are not necessary for good yields. In parts the water table is relatively close to the surface and non-irrigated lucerne crops will thrive in warm weather despite low rainfall periods.

Soils of the Lower Slopes.

On the moderate and gentle slopes at the foot of the ridges, the soils are dark brown, brown and light brown fertile clay loams, mostly derived from basalt. The surface soils are friable and of moderate depth, though there are places where they are shallow. Because rain does not penetrate freely through the heavy clay subsoil, the surface soils on the slopes erode readily.

Plate 3.

Farmlands at Innisplain in the Beaudesert District, with "Telemon" Homestead in the Distance.

In the virgin state these areas carry open forest with grass, the main trees being narrow leaf ironbark (*Eucalyptus crebra*), blue gum and Moreton Bay ash (*Eucalyptus tesselaris*).

Crops grown on these soils include maize, sorghums, field peas, lucerne, and pumpkins.

Soils of the Softwood Scrubs.

These soils occur principally on Tamborine Mountain and Beechmont Plateau. They have been derived from rocks of volcanic origin and are very deep, friable, red loams and clay loams which merge gradually into a red, fairly friable clay in the deep subsoil. The soils are used mainly for horticultural crops, which grow very successfully, and for pastures on dairy farms. Though the inherent fertility of these soils is fairly high, fertilizers give economic responses when used on crops of high value.

Soils of the Ridges.

Open forest with grass covers the ridges in the virgin state but the trees are stunted. The main species are narrow leaf ironbark, bloodwood (*Eucalyptus gummifera*) and spotted gum (*Eucalyptus maculata*).

The soils are gravelly and lack fertility; they are unfit for cultivation because of the steepness of the slopes.

WATER FACILITIES.

The district is very well watered, having the Logan and Albert Rivers, Canungra Creek and numerous auxiliary creeks which are always running and which provide excellent water for stock and irrigation purposes.

Portions of the district are swampy, while some lowlying alluvial flats are liable to inundation by floods during the summer wet season. Little attempt has been made to provide drainage on lowlying lands, but it is believed that much land suitable for cultivation purposes could be reclaimed if suitable drainage schemes could be put into operation.

Plate 4.

Alluvial Flats on the Albert River, Beaudesert District.

PASTURES.

Native Pastures.

The native grasses provide good feed for short periods following spring and summer rains but deteriorate quickly in the late autumn and are of little value during the winter months. The main species found are Queensland blue grass (*Dichanthium sericeum*), forest blue grass (*Bothriochloa intermedia*), kangaroo grass (*Themeda australis*) and wire grasses (species of *Aristida*). Pitted blue grass (*Bothriochloa decipiens*) is common in overgrazed pastures, while barbed wire grass (*Cymbopogon reflexus*) and love grasses (species of *Eragrostis*) are also present in most native pasturage.

Native and naturalised legumes are fairly numerous and enhance the feed value of the native pastures. The most common legumes are Glycine pea, Phasemy bean (*Phaseolus lathyroides*) and *Desmodium muelleri.*

Introduced Pastures.

Paspalum is the common introduced grass and many thousands of acres are carrying excellent stands of this species, mainly on the alluvial flats and lower slope soils.

Rhodes grass is fairly common on some of the softwood scrub soils and produces an excellent body of feed during the summer months. Kikuyu, however, is the main grass grown on the softwood scrub soils. This grass produces excellent feed during the whole year on these soils, which are almost frost-free. It also prevents considerable erosion on the steeper slopes.

Plate 5.

Dairying Country Close to the Town of Beaudesert.

Green panic, blue panic and buffel grasses are new introductions to the Beaudesert district. Some paddocks have recently been planted with these species but insufficient data are available yet to determine their usefulness for the district.

Several pasture legumes do very well in the Beaudesert area, the most common being white clover, burr medic and black medic. Red clover has done very well in pasture trials. White clover has become established throughout the whole district, particularly on the alluvial river and creek soils and on the softwood scrub soils.

A number of farmers have shown interest in the treatment of hillside pastures with furrows ploughed on the contour. This practice has definitely improved the carrying capacity and quality of the existing grasses.

Pasture furrows set out on softwood scrub soils have given good results when planted with kikuyu grass.

WEED PROBLEMS.

The main weed problems occur on alluvial soils adjacent to the rivers and creeks. The worst weeds are Noogoora burr (*Xanthium pungens*), nut grass (*Cyperus rotundus*), Johnson grass (*Sorghum halepense*) and Datura (*Datura stramonium*). Groundsel bush and Crofton weed have both appeared on the headwaters of creeks and rivers and in scrub areas. Brushing and the application of weedicides to the new growth are employed against these weed pests.

Sodium chlorate at the rate of 1 lb. per gallon has been used with some success on Johnson grass, while hormone-type weedicides are used for Noogoora burr. Nut grass can be controlled to some extent by intense cultivation during spring and summer months. Moreover, frosts check it considerably during the winter months.

Plate 6.

Tamrookum Flats, Beaudesert District.

AGRICULTURAL CROPS.

The major agricultural crops grown fit in with the dairying and pig raising industries. Lucerne, maize, sweet sorghums, Sudan grass, pumpkins and small areas of cowcane are grown with success during the summer months.

Oats, wheat, barley and field peas are the main winter crops and are primarily used for grazing purposes.

Maize.

Maize is the only grain crop grown in the district. Grain sorghums are not grown, mainly because of the risk of damage caused by insect pests and birds.

The area planted to maize for grain each year is about 4,000 acres. The average yield is usually high, over 110 bushels per acre having been recorded from a hybrid maize crop. The main varieties grown in the past were yellow dent strains and the white variety Silvermine, but hybrid maize varieties are rapidly becoming popular.

Plantings are made from September to January, but the best yields are usually obtained from the late planting about November and December. Rate of planting varies slightly, 8 lb. of seed per acre being the usual rate.

Plate 7.

Dairying Country at Tabragalba, near Beaudesert.

Lucerne.

The area under lucerne each year is also about 4,000 acres. This crop is grown mainly on the alluvial soils, and though excellent water is available, only a very small percentage of the lucerne land is irrigated. The average yield is about 4½ tons of hay per acre per year. Maize, pumpkins and winter grazing crops are commony used in rotation with lucerne.

Most of the crop is retained on the farms for feeding to dairy stock and only a small amount is sent to the market as chaff or baled hay.

Pumpkins.

Beaudesert pumpkins are appreciated on the market for their good quality. The dominant type is known as ''Beaudesert'' or ''Queensland Blue.'' This varietal type, which is intermediate between that of the Crown and Ironbark varieties, is at present in a somewhat variable state, comprising a number of sub-strains. The general quality of the product, however, is regarded very highly.

The area under this crop exceeds 1,500 acres annually. The average yield of table pumpkins is 4-4½ tons per acre.

Summer Fodder Crops.

Large areas of maize are planted during spring and summer months as feed for dairy cattle. In this instance the seed is usually drilled in at a very heavy rate per acre. When the crop is in the milky cob stage it is cut and fed as green chaff or ensiled.

Sweet sorghums are also used as ensilage crops. Some concrete tower silos are used for this purpose but the popular type is the trench silo. Saccaline is the main variety of sweet sorghum planted. It is grown extensively during the spring and summer months, and as well as being used for ensilage, it is chaffed green and fed directly to cows.

Plate 8.

Grazing Land at Tabragalba, near Beaudesert.

Cowcane is grown in the softwood scrub areas above frost level, but the lower slopes and alluvials are too cold for this crop. Cowcane acts as a very useful standing fodder reserve for dairy cows and is usually chaffed and mixed with lucerne before feeding to stock.

Winter Fodder Crops.

Oats, wheat, barley and field peas are grown during the winter months for grazing stock in the field or for cutting, chaffing and feeding at the bails.

About 2,000 acres are under grazing oats during the winter months. The main oat variety planted is Algerian, but newer varieties such as Klein, Fulghum x Victoria and Victoria x Richland, particularly the last, are increasing in popularity because of their rust resistance.

Miscellaneous Crops.

About 250 acres are planted to potatoes. They grow very well under irrigation on the alluvial soils. Factor is the common variety but Sebago is increasing in popularity. The average yield of good crops exceeds five tons per acre.

Small acreages of onions are also planted and give satisfactory yields.

HORTICULTURAL CROPS.

Horticultural crops are extensively grown on Tamborine Mountain for the Brisbane market. Water facilities are good and it is possible for farmers to irrigate from creeks which provide ample supplies of water throughout the year.

The main crops grown are beans, peas, tomatoes, rhubarb, cabbage and cauliflower. Citrus is also grown commercially.

Tomatoes are cultivated on the alluvial soils near Beaudesert with very good results.

Plate 9.

Cultivated Flats in the Tabragalba Area.

DAIRYING.

The change from cattle raising to dairying began about 1905 and the larger holdings were gradually cut into blocks of from 200 to 500 acres. In some instances this change-over was effected without changes in ownership, the more fertile sections of grazing properties being turned into share farms.

The district is served by a modern butter factory located at Beaudesert. Butter production at this factory has exceeded three million pounds annually in recent years. Cream from Tamborine, Beechmont, and Canungra districts is supplied to the Kingston butter factory.

A large quantity of fresh milk is also supplied to Brisbane from the Beaudesert district.

The number of dairy cattle in the district in 1949 exceeded 70,000. A number of herds are hand fed all the year round. Lucerne provides abundant grazing in the summer, while oats, wheat and lucerne are grazed during the winter months. Tamborine and Beechmont dairy farmers are not in a position to cultivate large areas due to the steep slopes. However, the country carries an excellent body of kikuyu grass in the summer months. During the winter, white clover comes away very freely in the kikuyu pasture, giving excellent grazing for the dairy herds.

PIG RAISING.

Pig raising is carried out extensively, some excellent quality Berkshire and Tamworth pigs being obtained yearly by various stud farms. Weekly pig and calf sale figures are very high. More than 20,000 pigs and 25,000 calves are sold annually, buyers coming from Brisbane every week to attend sales.

Plate 10.
Loading Lucerne Hay in the Logan River Area.

THE GRAZING INDUSTRY.

Much excellent grazing land is available and many high quality beasts are turned off each month. Herefords are the most popular breed in the area.

In some instances graziers are growing lucerne, but in most cases the cattle are grazing on paspalum and native pastures. The average size of grazing holdings is approximately 8,000 acres.

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	D. Sullivan, " Bantry " Stud, Rossvale, *via* Pittsworth
	W. Henschell, " Yarranvale," Yarranlea
	Con. O'Sullivan, " Navillus Stud," Greenmount
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	A. H. Sokoll, " Chelmsford," Wondai
Ayrshire	L. Holmes, " Benbecula," Yarranlea
	J. N. Scott, " Auchen Eden," Camp Mountain
	"St. Christopher's and Iona" Studs, Brookfield Road, Brisbane
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Guernsey	C. D. Holmes, " Springview," Yarraman
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The Apple.

K. M. WARD, Senior Horticulturist, Horticulture Branch.

THE apple (*Malus sylvestris* Mill.) is one of the most ancient of the cultivated fruits, its cultivation in Greece dating back at least to 600 B.C. The tree is indigenous to Asia and is believed to have its origin in the Caucasus Mountains, which lie between the Black and the Caspian Seas. The crop is now cultivated in most temperate countries of the world and the apple has become one of the most widely used domestic fruits.

In Queensland, the history of commercial apple production is virtually the history of the Stanthorpe district, for with the decline of tin production in that area in the 1880's, apple and other fruits became increasingly important there. The first apple trees were planted in 1873, only two years after the tin mines commenced operations, and by 1900 the industry was well on the way to establishment. Rapid development took place after the first World War and the importance of deciduous fruits in the area has steadily increased since that time.

Climatic factors restrict commercial apple growing in Queensland to the Stanthorpe district, for though its latitude of 28.5° is only 5° south of the Tropic of Capricorn, an elevation of 2,500 to 3,500 feet above sea level provides the necessary winter chilling requirements of the trees. The combination of suitable soil and climate required by apple trees does not appear to be met satisfactorily elsewhere in Queensland.

Apples constitute the principal deciduous fruit crop of the State and the area under the crop (7,000 acres) is exceeded only by pineapples and bananas, and is approximately equalled by citrus. Production has shown an upward trend over the past 10 years and now averages about half a million bushels per annum. Because of the relative earliness of the crop, the fruit is usually sold on a satisfactory market both inside and outside the State. However, the bulk of the crop is marketed in Queensland, though a small portion is exported to the Orient.

CHARACTERISTICS OF THE APPLE TREE.

Growth Cycle.

The growth cycle of apple trees in the Stanthorpe district may be summarised as follows:—

Dormant or resting period	May to late September
Root growth (mainly) ..	September-October and February-April
Bud break	Late September
Blossoming	October
Shoot growth	October to March
Fruit bud initiation	December to January
Fruit development	October to January and later
Fruit maturing period (all varieties)	January to April
Leaf fall	April to May

The dormant period lasts four to five months and the active growing period seven to eight months.

Chilling Requirements.

The apple tree is more resistant to cold than most other fruit trees, and when completely dormant some varieties such as McIntosh can survive temperatures as much as 50° or 60°F. below freezing point. The buds require more winter chilling than those of most deciduous fruit trees, and unless the trees are subjected to a cold period of two to three months with an average temperature of 48°F. or less, many buds may fail to open. Warm winters are therefore often followed by reduced crops of fruit which mature irregularly over a prolonged period.

Flowering and Fruiting Characters.

Flower bud differentiation begins in the summer preceding the spring in which the tree blossoms—that is, nine or 10 months before the blossoms actually appear. During this period, bud development may take place at any time when temperatures are above 40°F. On the breaking of dormancy, the flower buds swell more quickly than the leaf buds.

The flower-bearing buds are mixed buds which on opening carry a cluster of about five flowers at the apex and a number of leaves at the base. The buds are usually borne on one-year-old wood, either terminally or laterally. Much of the fruit is carried on spurs (Plate 11), but the amount of spur-borne fruit depends on the variety. The spur is usually defined as a modified shoot with limited growth and very short internodes, but there is no sharp distinction between spurs and shoots, for a spur may sometimes produce one or more normal shoots. Spurs produce flowers and leaf buds for many years. As the flowers on a spur are borne terminally, elongation of the spur takes place from side buds; hence the zigzagged gnarled appearance shown by old spurs. The development of this lateral growth permits regular fruiting on the spur, but the new growth becomes less vigorous with the age of the spur and may eventually cease. The spur-bearing habit gives rise to a compact type of tree growth. Well known varieties which bear their fruit mainly on spurs are Granny Smith and Delicious.

Plate 11.

Fruit-bearing Wood of the Apple. Left, young spurs and shoot; right, spurs.

The apple tree also bears fruit on shoots other than spurs, the flower bud commonly being formed at the apex of the shoot, but flower buds may also arise laterally. This habit is more common in young trees than in mature ones and suitable pruning methods permit such shoots to be commercially useful. The Jonathan is one of the varieties which bear a large portion of the crop on laterals.

Flowers of the apple are true hermaphrodites, and therefore contain both male and female parts. Nevertheless, all varieties are not self-fruitful or capable of producing fruits with their own pollen. Many do not produce fruits when self-pollinated and they are then said to be self-incompatible. A moderate degree of self-incompatibility is desirable because it tends to limit over-bearing and alternate bearing. Varieties which are highly self-incompatible can usually be induced to bear good crops by interplanting with other varieties to ensure cross-pollination, and production in practically all apple varieties is increased by such interplanting. The degree of self-fruitfulness varies not only with varieties but also with the age and vigour of the trees, soil conditions, nutritional status and climate.

BOTANY OF FLOWER AND FRUIT.

The flower of the apple is shown diagramatically in Plate 12. Pollination is effected mainly by bees and involves the transference of pollen grains from the anthers to the stigmas. Fertilisation follows the germination of the pollen grains and the transference of a male cell via the pollen tube to the female egg cell. In subsequent growth, the thick tissue around the ovary of the flower, formed by the fusion of the bases of the petals, stamens and sepals and known as the receptacle, forms the greater part of the flesh of the fruit. A small proportion of the inside flesh grows from the ovary itself. The fruit is called a pome and is characterised by five parchment-like, leathery or papery carpels at the "core" (Plate 13). Because the fruit develops mainly from the receptacle and not solely from the ovary, it is botanically a false or spurious fruit.

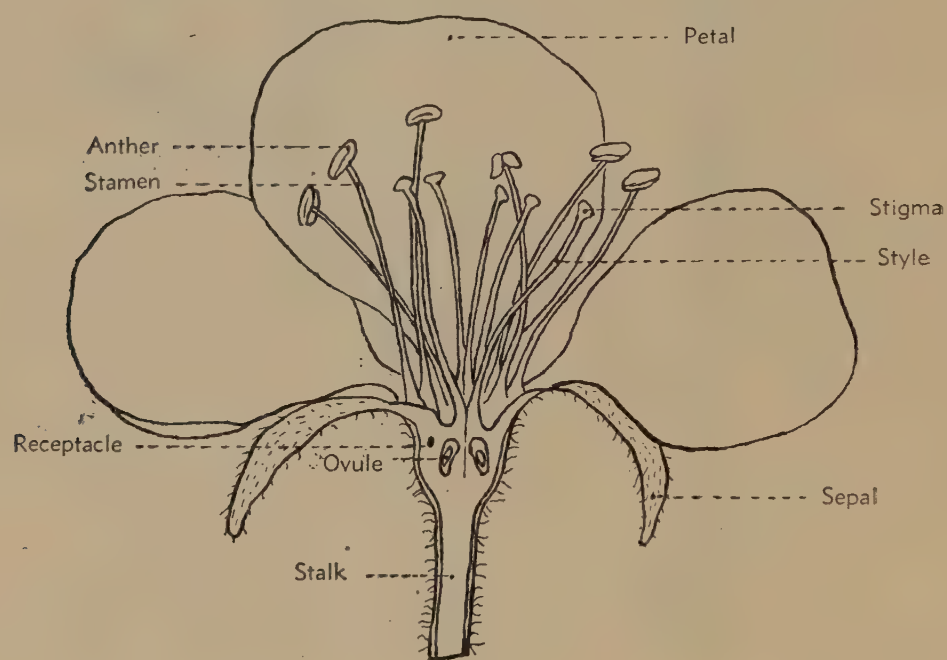


Plate 12.

Diagram of the Apple Flower.

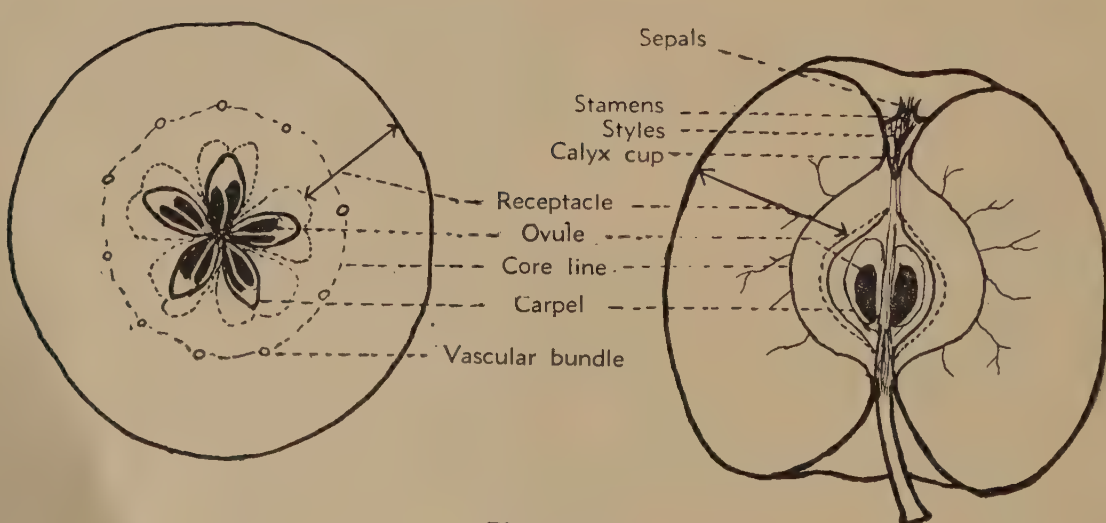


Plate 13.

Diagrams of the Mature Apple Cut Across in both Directions.

PRINCIPAL QUEENSLAND VARIETIES.

The apple industry in Queensland is based primarily on three varieties—Granny Smith, Delicious and Jonathan—but others of some importance are Gravenstein, McIntosh Red and Winesap. A few well-tested varieties are preferable in commercial plantings to a wide range of types with a limited market. Consumers are well acquainted with the Granny Smith, Delicious and Jonathan, all of which do particularly well in the Stanthorpe district.

Granny Smith originated as a seedling at Eastwood (New South Wales) about 1868 and was named after Mrs. Thomas Smith, who propagated trees from the parent. The fruit is a uniform green in colour, becoming yellowish-green at full maturity; yellowing, however, is generally a sign of over-maturity. It is excellent for culinary purposes and is becoming increasingly popular as a dessert apple. The fruit matures late—between mid-March and mid-May at Stanthorpe—and has a longer storage life than any other locally grown variety. Because of this and its excellent quality, Granny Smith is the main variety grown in Queensland. The tree grows vigorously and consistently bears good crops.

Delicious is a very attractive red apple, commonly striped but often red all over. It matures over a relatively short period during February and March, and is used as a dessert fruit. The storage life of the mature fruit is relatively short, but if picked at an early stage of maturity it keeps well in cold storage and is suitable for export.

A bud sport from Delicious, discovered in north-eastern Tasmania, is known as *Lalla*. The fruit resembles Delicious but has a deeper, more uniform colour and the flesh is a little firmer. However, in some seasons it is rather more subject than Delicious to mouldy core and is therefore less suitable for cool storage. The fruit matures during February and March; the tree is as vigorous as Delicious.

Jonathan is usually a red apple with the colour distributed over most of the surface. It is grown mainly as a dessert apple but also is suitable for cooking. The crop matures during early February to late March. Picking must be timed correctly, for the fruit shrinks if picked too soon and breaks down quickly if over-mature. Its storage life is relatively short but it is useful for some export markets. The tree crops consistently on a wide range of soils but does better in a moderately warm moist climate than in a hot dry one.

Gravenstein is a pale-yellow apple streaked and dotted with red and its flavour is as attractive as its colouring. It matures in January and is the first dessert apple to be marketed from the Stanthorpe district. The tree is vigorous in its early years but tends to decline earlier than most other varieties. Premature shedding may occur as the fruit approaches maturity.

McIntosh Red is an early mid-season variety maturing in January and February. It possesses an attractive crimson colour and is used mainly as a dessert fruit. When over-mature its flesh soon becomes mealy. The variety does not store well and the trees show a marked tendency to drop maturing fruit.

Winesap is a dark red, often streaked, apple with scattered russet dots. The fruit has a firm flesh, good flavour and is used for dessert and cooking purposes. The tree is vigorous and matures its crop in February and March. Stayman Winesap is derived from a Winesap seedling but, in comparison with Winesap, has a larger fruit with a dull red ground colour and russet dots, a softer flesh and rather inferior keeping qualities.

Other Varieties.—Early cooking apples which grow satisfactorily in the Stanthorpe district are Lord Nelson and Twenty Ounce. Dessert types of minor commercial interest are Doherty and Red Statesman.

SOIL REQUIREMENTS.

Though apple trees are less exacting in their soil requirements than many other fruit crops, an uncongenial soil alone can nevertheless reduce yields to an unprofitable level. No orchard, therefore, should be planted before both the surface and sub-surface soils of the proposed site have been carefully examined, preferably with a soil auger. The crop is grown quite successfully in soils ranging from clay loams to sandy loams or even coarse sands, provided the sub-surface soil is sufficiently permeable to allow the free downward movement of water, thus ensuring adequate aeration of the roots. Vigorous growth cannot be expected where an impervious layer of stiff clay or a hardpan near the surface causes waterlogging, or where bedrock approaches the surface.

In compact, poorly aerated soils, root growth is slow and the supply of nutrients and water to the tree is restricted. Under such conditions trees tend to produce straggling branches with slender shoots which lack robustness. Such trees are stunted, often "staggy," and have a relatively short life. They usually grow more slowly in spring and shed their leaves later in summer than more vigorous trees. They are also liable to drop their fruit under adverse conditions such as a very wet summer, and the mature fruit may be dull in colour with a short storage life.

Poor aeration and restricted water movement in the soil are usually indicated by red and yellow mottling in the profile, often with ironstone concretions.

The Granny Smith is an adaptable variety which thrives in many soil types, some of which are not particularly well drained. On the other hand, Delicious and Lalla cannot tolerate a badly-aerated soil and they should therefore be planted in the best soil available in the orchard. Jonathan is less exacting than Delicious in its soil requirements. All varieties, however, grow best in a deep, well-drained soil.

Trees growing on the relatively shallow-rooted Northern Spy stock (Plates 14 and 15) do not need as deep a soil as those growing on the more vigorous, deeper root systems such as those developed by French Crab seedling and some Malling stocks.

Apple trees are grown successfully in soils which are strongly acid (pH 4.5) to alkaline (pH 8.0). Stanthorpe soils range from approximately 4.5 to 6.0 and heavy liming to correct acidity is seldom necessary, though lime may sometimes be required for calcium nutrition.

Stanthorpe Soils.

The orchard soils of the Stanthorpe district are of a granitic nature and can be divided into two main types—granitic and alluvial.

The granitic type (Plate 16) is derived from the weathering and decomposition of coarse-grained granite, and has either remained where it was formed or has accumulated at the foot of slopes and in the valleys, often to a great depth, as a result mainly of water wash. This soil type ranges in texture from a very coarse to a fine sand and it commonly displays a deep and open profile, particularly in some of the valleys. The surface or A1 horizon is invariably a coarse sand, darkened somewhat by organic matter. The sub-surface or A2 horizon is usually

Plate 14.

Diagrams of the Root System of a Seven-year-old Granny Smith Apple on Northern Spy Stock. Top, plan of complete root system; middle and bottom, sections showing depth of root penetration.

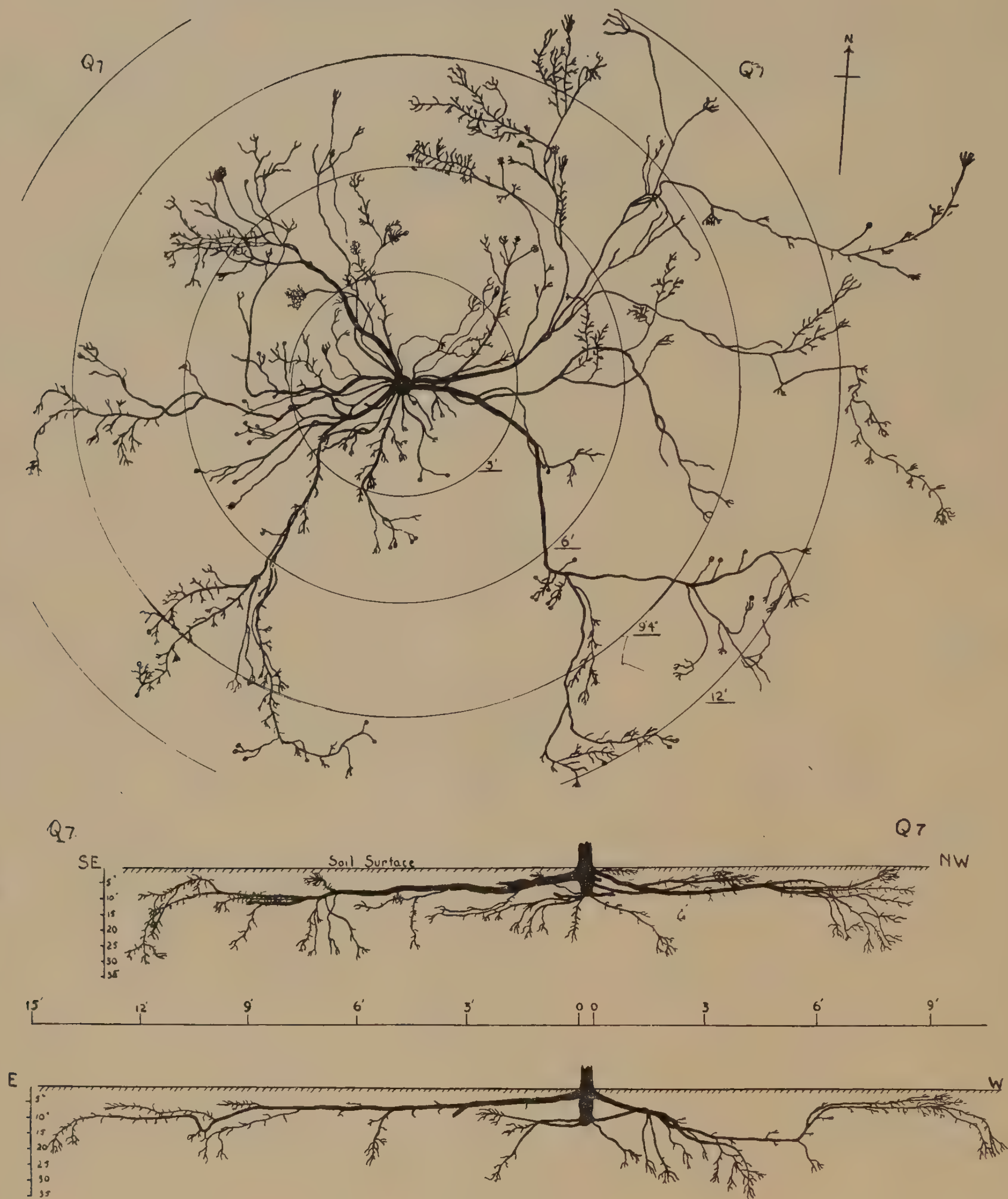


Plate 15.

Diagrams of the Root System of an 18-year-old Granny Smith Apple on Northern Spy Stock. Top, plan of complete root system; middle and bottom, sections showing depth of root penetration.

grey to greyish-yellow in colour and still very sandy, but may sometimes contain a small amount of clay. Its depth is seldom less than two feet but much deeper soils are found in some valleys. Beneath the surface and sub-surface layers are the B and C horizons, composed respectively of decomposing granite and parent rock. A shallow phase of this soil type occurs in some areas. It has a very coarse, grey sand in the surface layer but at a depth of 15-24 inches is a compact, impenetrable layer made up of coarse grains fused with a cementing material which is floury when dry.

The deep granitic soils in which apples are usually planted provide excellent conditions for root development but their water-holding capacity is low and tree growth consequently suffers in dry weather. Trees grown on the shallow phase of this soil type show marked stunting accompanied by poor root development.

The alluvial type of soil (Plate 17) is less extensive than the granitic. The surface soil is heavier than that of the granitic type and is described as a sandy loam to loam; its is usually characterised by the

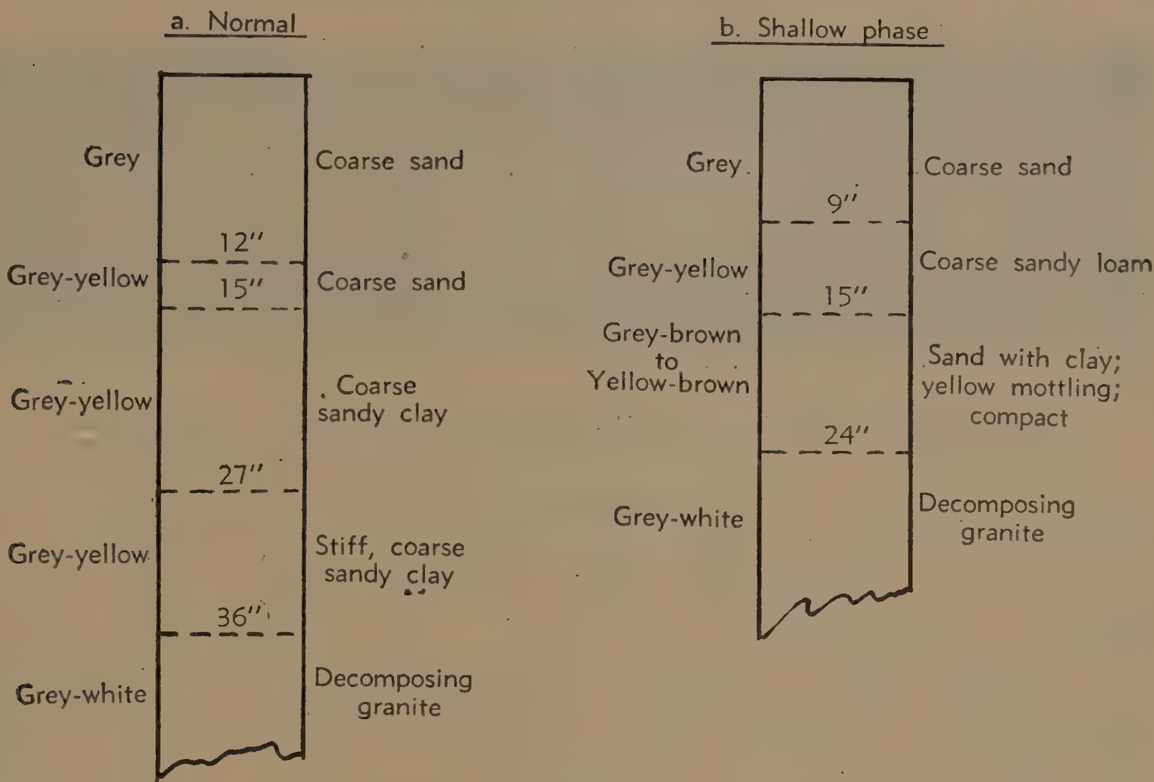


Plate 16.

Profiles of Granitic Soil Types of the Stanthorpe District.

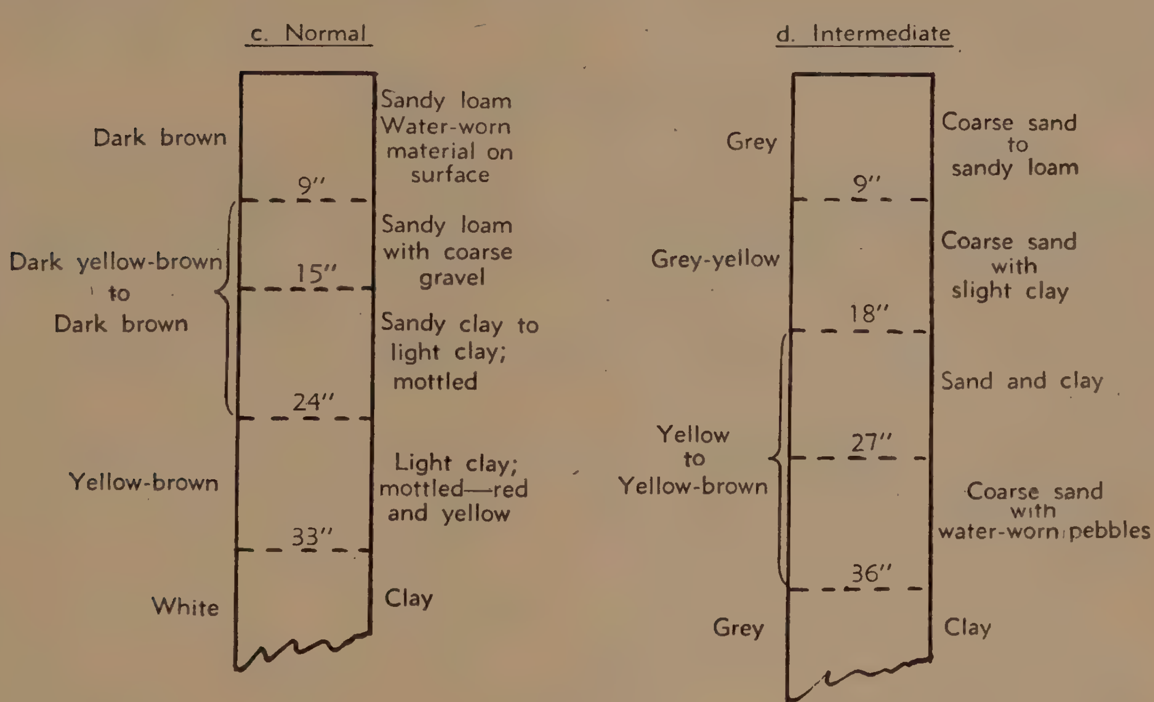


Plate 17.

Profiles of Alluvial Soils of the Stanthorpe District.

presence of water-worn material. The soil is somewhat shallow and the subsoil is rather heavy in nature, consisting of a clay loam; the frequent presence of red and yellow mottling indicates lack of aeration and restricted water movement. Nevertheless, this soil supports good apple orchards, though there is a noticeable decline in tree vigour where the soil becomes shallow. The fertility of this soil is greater than that of the more typical granitic soils.

A number of orchards are planted on an intermediate alluvial soil type (Plate 17), which is less loamy in the surface layer and is grey in colour.

[TO BE CONTINUED.]

PLANT PROTECTION

Potato Tuber Moth Control in North Queensland.

W. A. SMITH, Entomologist, Science Branch.

IN North Queensland the potato tuber moth (*Gnorimoschema operculella* Zell.) can at times be a serious pest of potatoes in the annual crop produced during the winter on the dry coastal area between Bowen and Ingham. Losses are most noticeable in the form of damaged tubers at harvesting time, but in late planted crops leaf damage can be intense enough to reduce tuber growth. While crops harvested before the end of August may escape the heavier losses of later crops, the adoption of a regular control practice will ensure maximum production under all conditions.

SEASONAL HISTORY.

Very little evidence of haulm injury by tuber moth larvae can be noticed on the crop until August, except in the tobacco areas, where leaf mines may be seen much earlier. Eggs are laid on the leaves or stems by the few moths which have bred on certain allied weed hosts, egg-fruit or volunteer tobacco plants during the summer-autumn period, or which emerge from tubers brought into the district for seed or table use.

When one generation of moths has bred on the tops, egglaying becomes more extensive and, after a mild winter, haulm damage can be quite serious while the tubers are still filling out. The initially higher populations of tuber moth in the tobacco areas will lead to earlier potential damage to potato tops in those areas.

Moth activity reaches a maximum towards harvesting, and if green tops are scarce, eggs may be laid on tubers exposed by soil cracking. As the tops die off due to age or disease, partly grown larvae from the leaves move onto the soil and attack tubers.

In sugar cane lands very little more is seen of the moth until the following year, since infested alternate hosts are not easily found during summer.

CONTROL MEASURES IN THE FIELD.

Preplanting.

Alternate hosts nearby can be given attention when the land is being prepared. If infested seed is received before the land is ready for planting, unusable tubers should be culled and the remainder lightly dusted with 2% DDT dust, then rebagged until required.

Growing Period.

By protecting the top growth from pests right through the life of the crop, the tubers will receive maximum benefit from the leaves, and in addition the tuber moth will not build up on the crop to large populations near harvest time.

DDT efficiently applied, preferably as a spray, will give this protection to the top growth from all the common pests. **However, experimental results have shown that spraying the tops will not alone prevent infestation of tubers, if hilling is not practised.**

Hilling.

The best results with furrow irrigation will be achieved by leaving any large hilling as late as possible before the sprawling of stems makes the operation impracticable. Sufficient soil cover is then present for the enlarging tubers, and root growth is not unduly disturbed while tubers are forming. Earlier soil working after the planting hill has been harrowed down should consist only of weed destruction and clearing the water furrow. Should top growth allow it, the hill can be covered again when it weathers down and cracks due to tuber growth, soil being taken from near the centre of the furrow. Often this is found impracticable, and frequent light waterings are relied on to seal the cracks. Covering the hill and lightly rolling when the tops have started to die off will help to protect tubers from infestation until the maturity of the skins permits harvesting.

Rate of Application of DDT.

Because of the large range of types of spraying and dusting machinery and forms of DDT now available, **the general recommendation for the date of DDT application is best expressed as one pound per acre at each treatment.**

If a spray is to be used the nozzles and pressure should be adjusted to give a good mist cover of the plant rows, and the amount of water required for the treatment of an acre found by trial. A DDT concentrate may then be diluted in water at a rate to give one pound of actual DDT to the acre. Similarly, the amount of a dust used on an acre should contain one pound of DDT.

As an aid in calculating, the following quantities of the common agricultural forms of DDT contain one pound of actual DDT:—

$\frac{1}{2}$ gal. of 20% emulsion.
$\frac{2}{5}$ gal. of 25% emulsion.
2 lb. of 50% dispersible powder.
50 lb. of 2% dust.

Timing of DDT Applications.

Growers should become familiar not only with the type of leaf injury caused by the larvae but also with the appearance of the actual moth, though the moths starting an infestation may be too few to notice.

DDT applications should commence soon after moths are first noticed in the field, or when the first leaf mines can be found by searching among the lower leaves. Spraying should then be carried

out two or three times at intervals of 2-3 weeks. More may be required if harvesting is still some weeks away and tuber moths are noticeable in the crop.

Harvesting.

Tubers should be dug at a rate slow enough to permit bagging within a few minutes of uncovering. This not only saves sun-scorching in the hotter months, but also keeps pest infestation down to a minimum.

As tubers are bagged in the field they should be treated with a 2 per cent. DDT dust at the rate of half a pound per bag.

A convenient method of using the dust is to place a small handful of it in the bottom of the tin used for picking up each time before it is filled.

Pineapple Export Regulations.

Stricter control of the handling and packing of pineapples for export from Australia now operates following the gazettal of amendments to the Commonwealth Fresh Fruit (Export) regulations, which the Department of Agriculture and Stock administers for the Federal Government. The objects of the change are to ensure that a high quality product only is marketed overseas, and that wastage is kept to a minimum.

Under the new regulations, pineapples grown commercially for export from Australia must be packed in approved premises situated in the locality in which the fruit is grown. Previously the fruit was allowed to be exported off the Sydney market floor. Application for registration of premises must be made to the Department, when the premises will be officially inspected to see that they comply with the regulations respecting hygiene and construction.

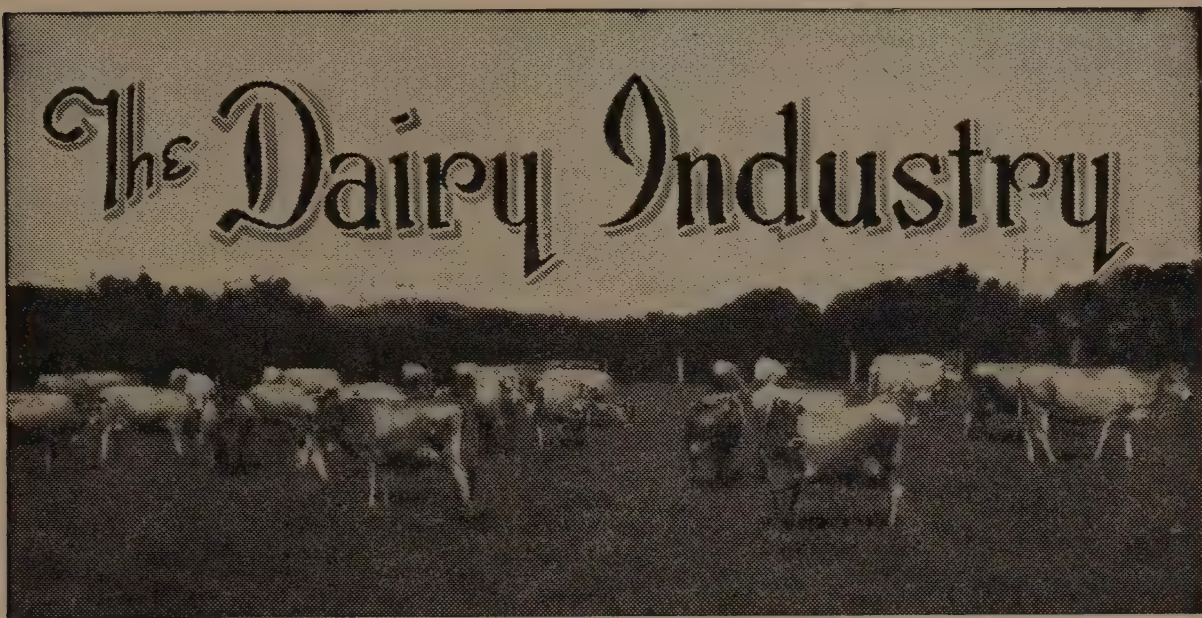
In addition, the fruit must now be cut from the plant, be of prescribed size and maturity, packed according to regulations and have the trade description placed on the case.

Experimental consignments to New Zealand, handled and packed according to the new order, have opened up showing considerably less wastage than formerly.

A SPECIAL RADIO SERVICE FOR FARMERS

★ ★ ★

The COUNTRY HOUR, a special service for farmers, is broadcast DAILY through the National and Regional Stations from 12 to 1.



Dairy Building and Equipment Competition, 1951.

R. A. PAUL, Director of Field Services, Division of Dairying.

(*Continued from page* 351 *of the December issue.*)

IN last month's Journal some details were given of several of the prize winning entries in Zones 1 and 2. This article deals with prize winning entries in the remaining zones.

Zone 3 Winners.

Zone 3 included the districts of Dairying Division officers stationed at Toowoomba, Oakey, Chinchilla and Dalby, the judging being carried out by Senior Dairy Adviser G. R. Sigley. Little interest was shown in the competition in these areas and only three entries were received. The awards were:—

1st—L. C. Iseppi, Bowenville	345 points out of 395
2nd—I. B. Skerman, Kaimkillenbun	314 points out of 395
3rd—G. H. Lawrence, Taylor Road Mail Service	298 points out of 395

Mr. Iseppi's dairy buildings are constructed externally of chamfer boards painted cream, and so situated as to have a north-easterly aspect and to provide an ideal slope for drainage purposes. Shade and shelter are provided in the form of a covered yard and Bougainvillea and Cassia shrubs.

Reference to the ground plan (Plate 18) and Plates 21 and 22 will show the general layout of the buildings and yards. Overall length is 76 feet, width at the bails 43 feet, and width at the milk treatment section 29 feet.

The holding yards are well laid out, suitably subdivided, solidly constructed and embody a most convenient crush, equipped with a side opening gate and a diversionary gate at the crush exit which allows for the direction of the stock into any of three holding yards.

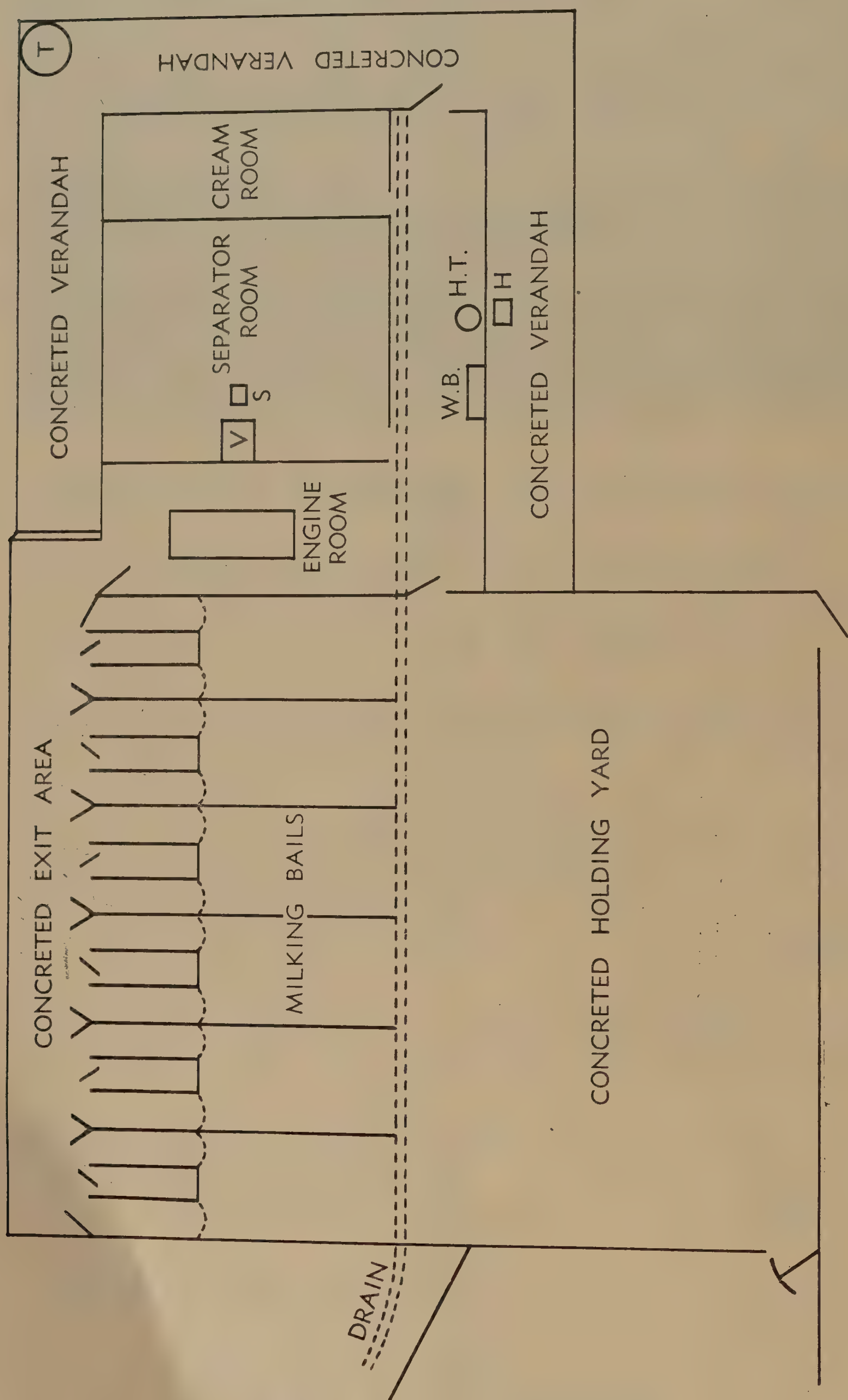


Plate 18.

Ground Plan of Building—Mr. L. C. Iseppi, Bowenville. W.B., wash-up basin. H, water heater; H.T., hot water tank; S, separator; V, milk vat;

The bails are equipped with a six-unit milking machine and have a 6 ft. 6 in. concreted exit area. They are lined, ceiled and ventilated by means of five latticed ceiling openings, and thence through the stationary roof ventilator which is common to the whole building.

Plate 19 is of a section of the interior of the bails, showing the features mentioned above.

Plate 20 features the ventilator doors provided in the dummies. These are swung on two ½-in. steel pins situated in the centre at the top and bottom of the door, and controlled by a stick inside the bails.

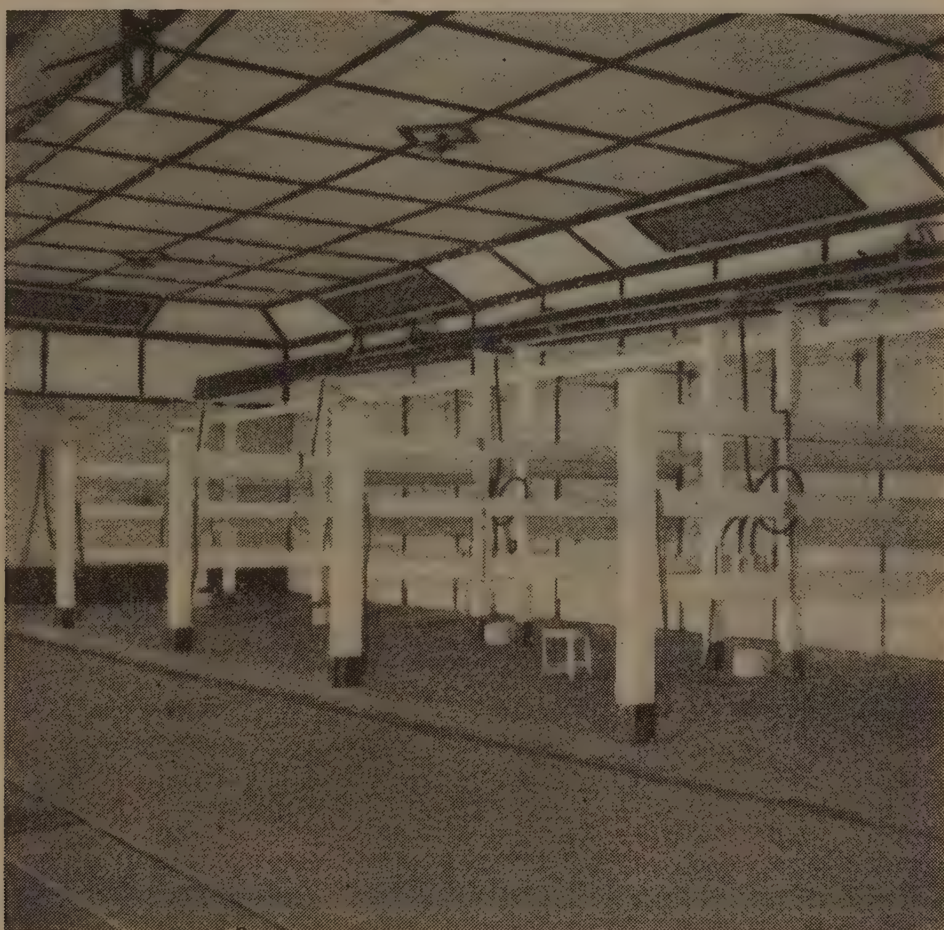


Plate 19.

Section of Interior of Bails—Mr. L. C. Iseppi, Bowenville.

The engine, separator and cream storage rooms are lined and ceiled, very well ventilated and attractively painted. The line from the skim milk pump and the water pipes enter through channels below the floor surface, thus obviating any floor surface pipes or piping attached to walls. Efficient air circulation is obtained through heavy dairy gauze cemented in around the base of the outside walls of these rooms. The veranda floor is nine inches lower than the inside floor.

A concrete cooling system is provided in which the cans are placed on a cement stand immediately above the water, thus avoiding can rusting. The cooling effect is obtained by means of two large air passages which pass downwards to a depth of at least nine inches below the surface of the water to diverge through 5 in. x 3 in. channels outside the building so situated as to catch the draught from any direction.

Plate 20.

Ventilator Doors in Dummies—Mr. L. C. Iseppi, Bowenville.

Plate 21.

Southerly View of Buildings—Mr. L. C. Iseppi, Bowenville.

The wash-up section, which is also lined, ceiled and painted, contains a 50-gallon chrome plated hot water storage tank and a wash-up trough, set in a galvanised flat iron drainage and storage bench.

Plate 21 is an exterior southerly view of the buildings showing the drainage area. The open cement drain extends 50 feet, is fenced off by a three-railed chain wire fence, and the area is planted with shrubs. Water supply is ample and suitable, being obtained from a bore feeding a 7,000 gallon storage tank. Water is laid on at various points in the building and stock are provided for by a trough serving two of the holding yards.

Plate 22 gives a general northerly view of the shed showing the sliding roof, lean-to verandahs and draining racks.

The sliding roof is nine feet above the floor at the highest point, has a very gradual slope and is independent of the milking shed roof.

It is supported by a $\frac{5}{8}$ in. steel rod and is transported by five moulded wheels on three 1 in. galvanised piping tracks. To set the roof in motion it is necessary only to release five nuts. The sliding roof enables the holding yard to receive the sun when necessary and so allow of drying out and purification of the concreted area. A block and tackle is used to replace the roof in position.

The second prize winner has a very solidly constructed shed of the hip roof type, painted externally, and part painted and part lime-washed internally. Adequate facilities are provided for the supply of hot water and water for general cleansing and stock purposes.

The buildings are on a satisfactory site facing north and drainage is good. The holding yards are very well constructed with strong gates and generally very suitable for the work.

Plate 22.

Northerly View of Shed—Mr. L. C. Iseppi, Bowenville.

Zone 4 Prize Winners.

Ten entries were received in Zone 4, which included the districts of Dairying Division officers stationed at Gympie, Murgon, Proston, Kingaroy, Nanango and Nambour. Judging was carried out by Senior Dairy Adviser M. R. Muller. Prizes awarded were:—

	Points.
First—Allen Bros., Chatsworth	367
Second—F. J. Fleiter, Conondale	344
Third—Est. A. A. Alcorn, Maleny	320

The modern dairy premises of Messrs. Allen and Sons are erected on a site featuring the advantages of natural drainage and a northerly aspect.

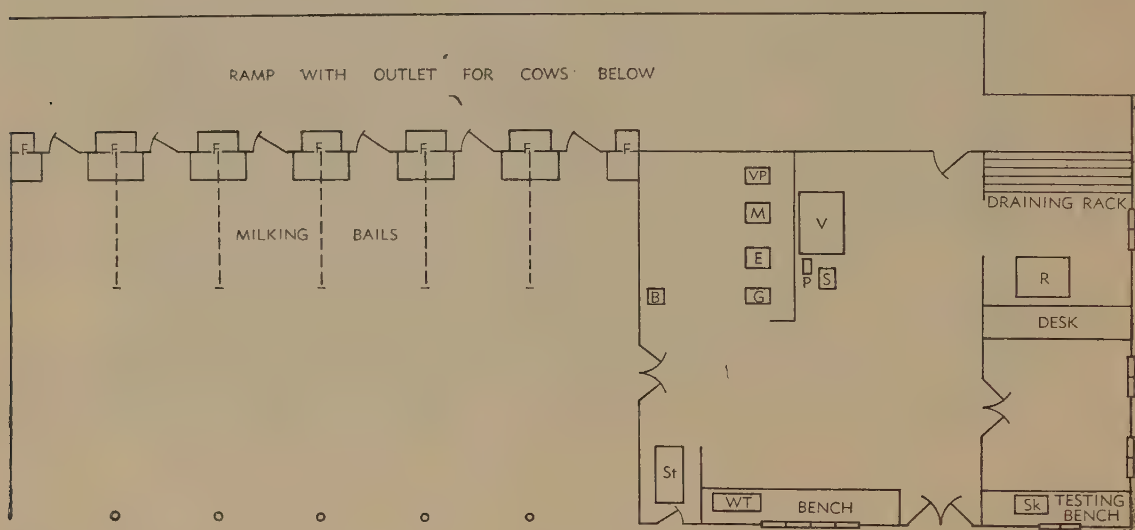


Plate 23.

Layout of the Shed Area on the Farm of Messrs. Allen Bros., Chatsworth. B, boiler; E, engine; F, feed bins and boxes; G, generator; M, motor; P, milk pump; R, refrigerator; S, separator; Sk, sink; St, sterilizer; V, milk vat; VP, vacuum pump; WT, wash trough.

Plate 23 gives the general layout of the shed area, in which excellent facilities are available.

The building is constructed of a concrete brick with the exterior walls of stucco, painted cream, and the interior walls plastered white. The whole building is ceiled and painted and the bungalow style roof is of corrugated asbestos.

Concrete has been used extensively to provide an exit race for the cows, assembly and holding yards leading to a spraying unit and a small drafting yard. Two smaller service yards adjoin the holding yard, with entrances from both the paddock and the yard.

Plate 24 gives a general view of the shed and yards.

Drainage is very efficient, all drains being wide and shallow and leading to a main drain below the spray dip. The main drain outlet has a series of gates by which the effluent can be directed to any one of four areas.

The six-unit shed contains tubular steel bails, a section of which is shown in Plate 25.

Plate 24.

General View of Shed and Yards—Allen Bros., Chatsworth.

A feature of the equipment in this shed is the provision of water in each unit. The line runs behind the fascia board and is fitted with taps, hoses and garden nozzles. The hose and nozzle is plainly visible in Plate 25. During milking the taps are turned on and the nozzles off. By simply turning on the nozzles, ample water is available for udder washing and bail cleansing.

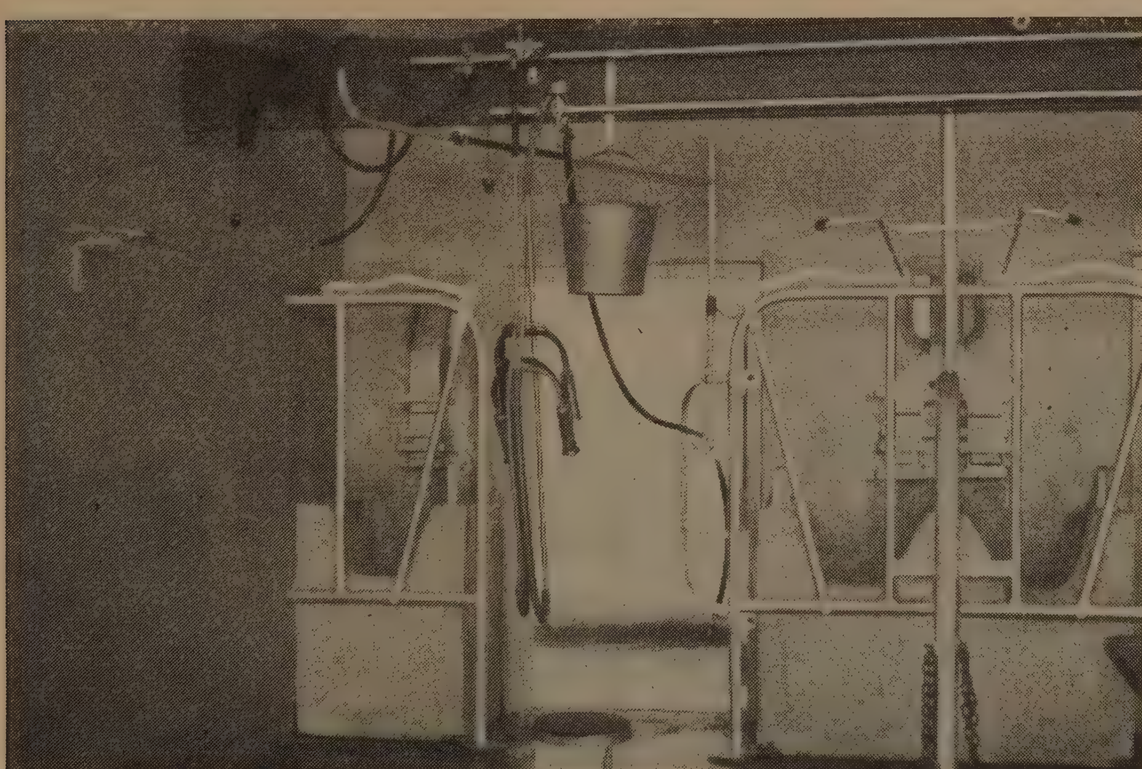


Plate 25.

A Section of the Bails—Allen Bros., Chatsworth.

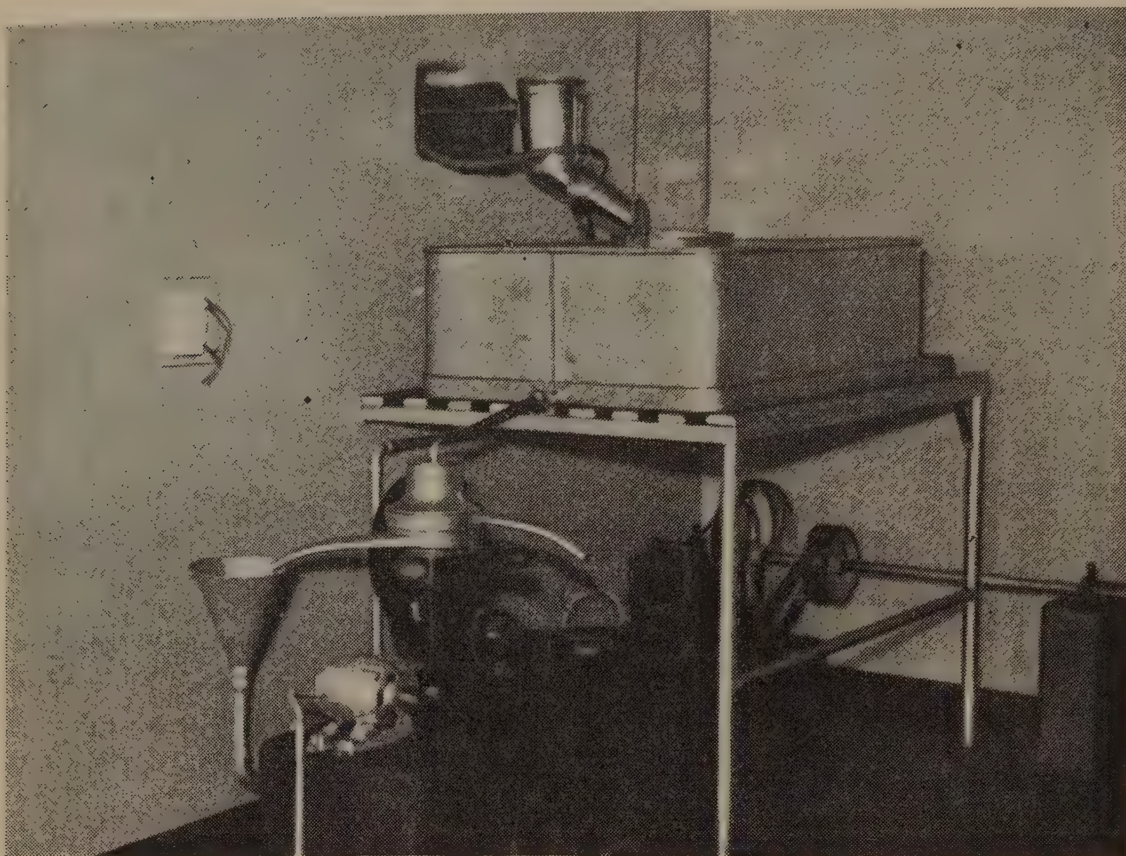


Plate 26.

View of Portion of Separator Room—Allen Bros., Chatsworth.

Plate 27.

Sterilizer, Wash-up Trough and Draining Rack—Allen Bros., Chatsworth. Note the glass louvres and the proximity of the steam boiler.

Other equipment includes electric motors, a six-unit milking machine, steam sterilizer, wash-up trough with steam valves, a tubular piping drainage rack, refrigerator, storage cupboards, Babcock tester, stainless steel sink, separator, milk vat and skim milk pump.

Interesting features of the skim milk line to the piggery are the provision of a tap outside the building enabling milk to be drawn off for calf feeding, and the fitting of a water line for flushing after use.

Plates 26 and 27 show some of the equipment.

Feeding of cows is carried out during milking, individual concrete feeding basins being located in each bail (Plate 25). Grain is held in hoppers 6 ft. high placed outside the bails and against the shed. These hoppers hold about 1½ bags of crushed grain and are replenished from a 6 ft. 6 in. high ramp running the full length of the building. Grain is released into the feed basins by manipulating slides above them.

Water supply, both rain and well, is ample. A 9,000 gallon tank constructed of concrete building blocks is used for rain water, and well water is pumped to a storage tank handy to the shed to be used for udder washing and bail sluicing.

The premises of the second prize winner (Mr. F. J. Fleiter, Conondale) utilise the natural advantages of drainage and northerly aspect afforded by the use of the top of a spur running practically east and west.

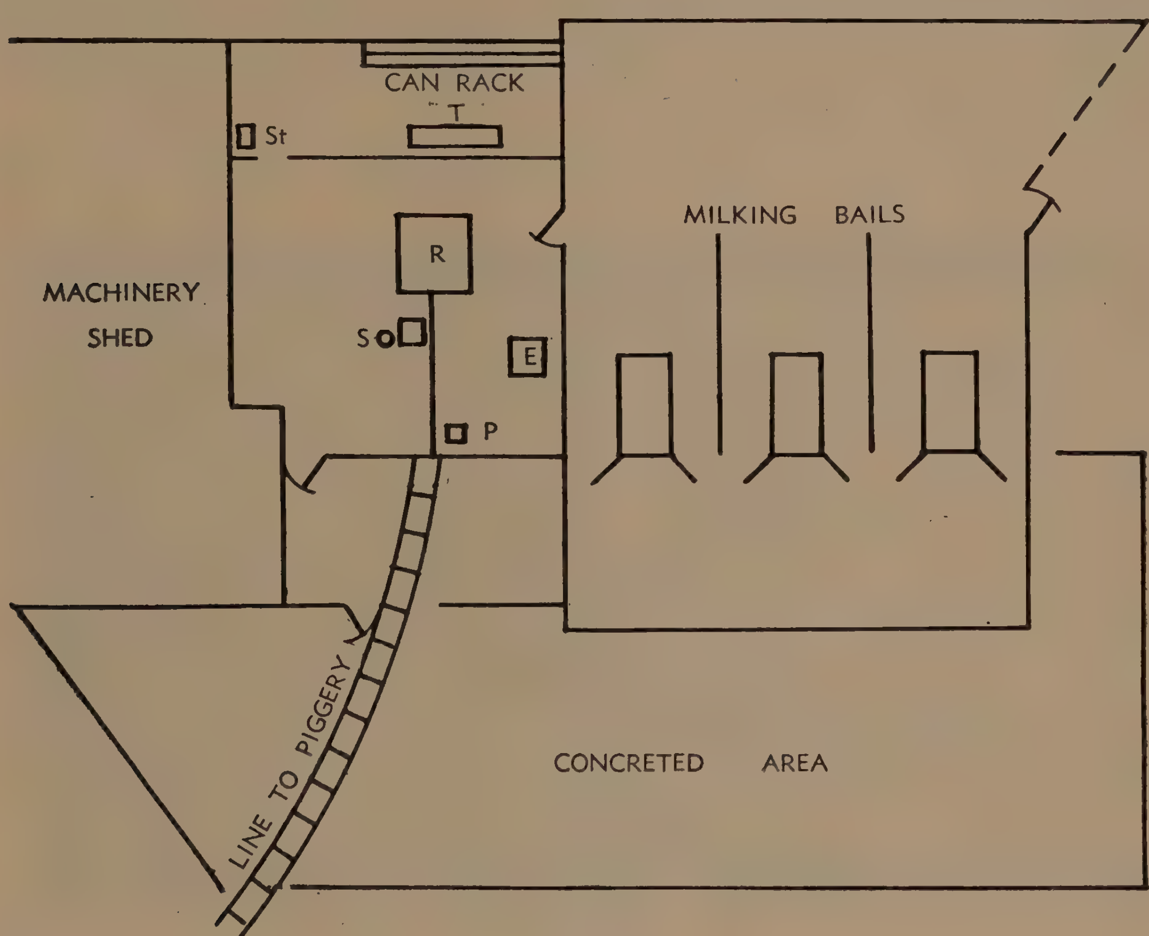


Plate 28.

Layout of the Building of Mr. F. J. Fleiter, Conondale. E, engine; P, pump; R, refrigerator; S, separator; St, sterilizer; T, trough.

The buildings, which are lined and ceiled, are constructed entirely of timber on concrete foundations and painted inside and out. The general layout is shown in Plate 28.

The holding yard is concreted and has a natural slope north and east, while the concreted exit apron has a natural slope south and east and drainage from these areas in both cases is taken by an underground drain well away from the buildings.

The premises are well equipped with a three-unit milking plant, separator, milk vat, sterilizer, wash-up trough, draining racks and refrigerator.

In the event of engine breakdown, oblong doors cut and fitted in the back of the engine room wall allow of auxiliary shafting being driven by a belt running from a tractor.

Separated milk is run by a spouting through the separator room wall into a tank fitted to a trolley which runs on rails, the slope being from the shed to the piggery.

Ample supplies of both rain and well water are available, the latter from an elevated tank fed by a windmill.

A hand wash basin is provided close to the wash-up room and a shower room near the elevated tank.

The surroundings of the bails and yards are well grassed with kikuyu grass, and with fig and silky oak trees in the background create very pleasing impressions of cleanliness and coolness.

The entry of the Estate of A. A. Alcorn, which gained third prize, is also of high merit. An unusual feature of some interest is the gate from the holding yard to the bails. This runs on overhead rails and so will not sag and cannot be pushed open.

Zone 5 Prize Winners.

Zone 5 included the districts of Dairying Division officers stationed at Maryborough, Bundaberg, Biggenden, Mundubbera and Monto and a total of nine entries was received. The judge (Senior Dairy Adviser W. A. G. Haylett) considered the entries of such quality that he asked for a special award.

Prize winners were:—

	Points.
First—Stollznow Bros., Bundaberg	352
Second—Mrs. E. Powell, Gin Gin	347
Third—C. G. Luthje, Monto	344
Special—R. R. Jarvis, Mundubbera	312

The winning entry is sited on a rise with natural drainage, central to the farm and with a north-westerly aspect. The general layout is shown in Plate 29.

The premises are constructed of wood and iron and are fully ceiled and suitably painted. The holding yard and bails area are concreted and the exit area is concreted out from the line of the bails. A feature of this shed is the provision of a water line with spray jets under the awning of the bail roof, permitting the flushing of the inner yard. The hip roof projects well forward and back and gives added protection from the weather.

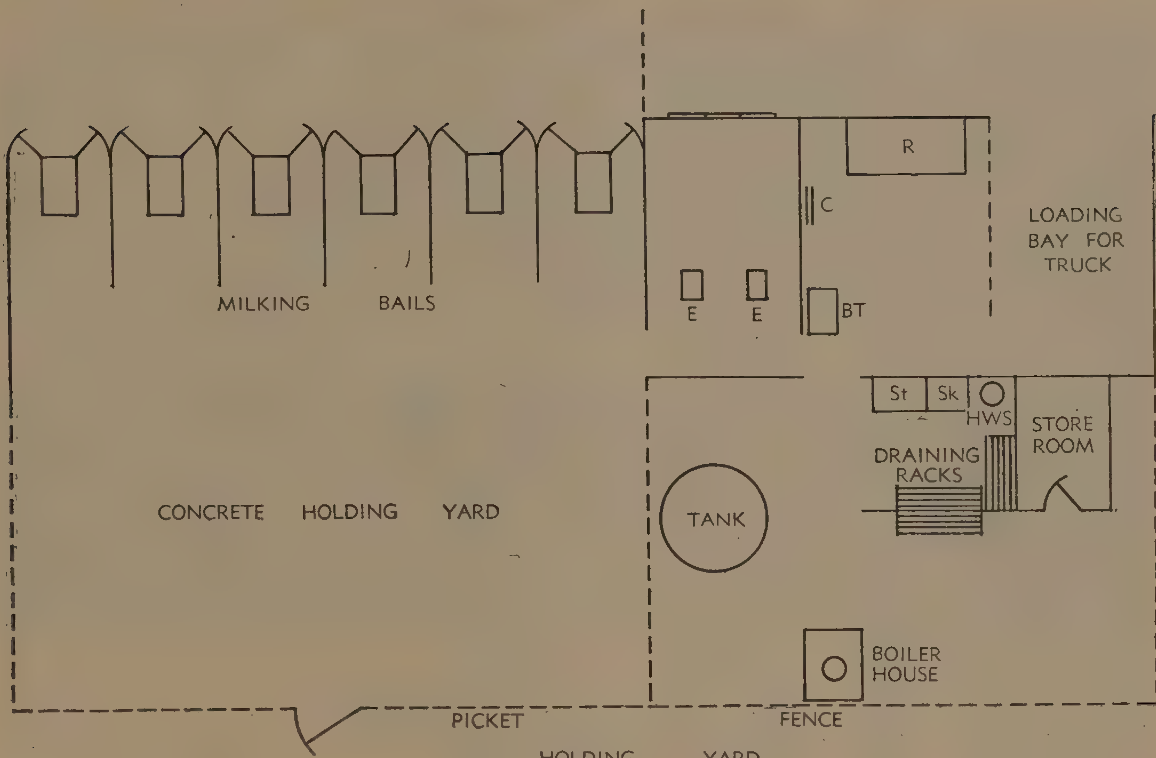


Plate 29.

Layout of the Shed of Messrs. Stollznow Bros., Bundaberg. BT, brine tank; C, cooler; E, engine; HWS, hot water system; R, refrigerator; Sk, sink; St, sterilizer.

Duplicate Diesel engines are installed to guard against a breakdown which otherwise would create a major disturbance with this farmer, who milks upwards of 250 cows.

The milk room is spacious and contains a refrigerator, surface cooler, and a bay to permit of can loading direct to a truck. Plate 30 shows some of this equipment.

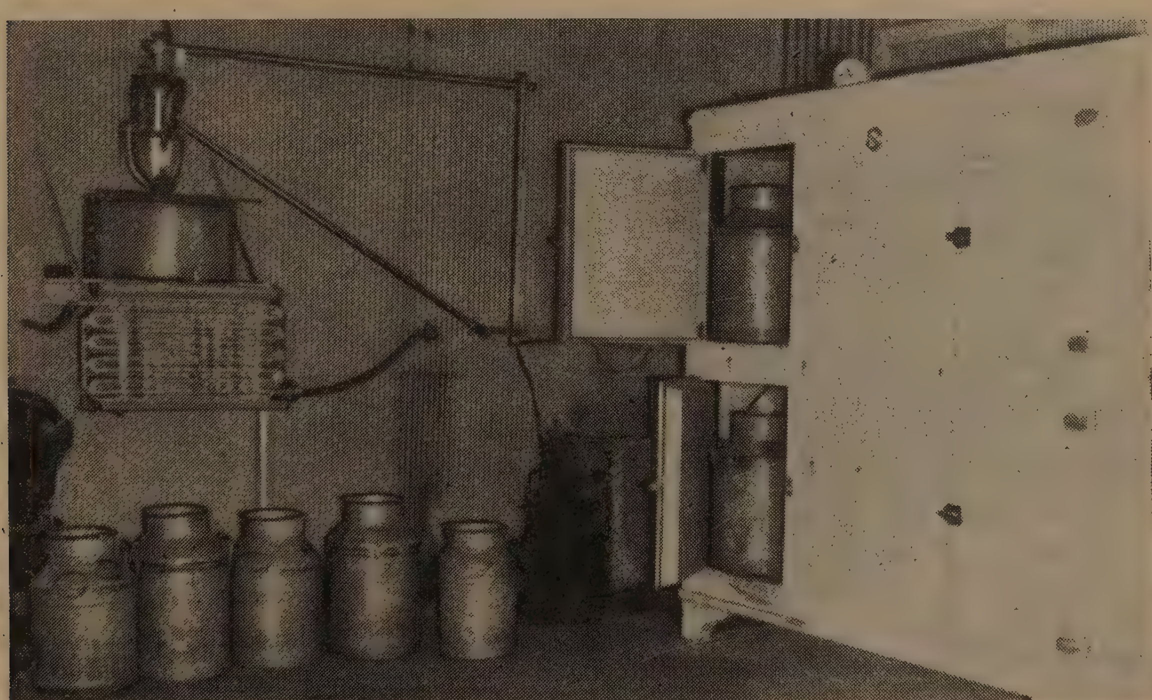


Plate 30.

Milk Room of Stollznow Bros., Bundaberg. Note the ripple iron walls, milk cooling equipment and the capacity of the refrigerator.

The wash-up section is shown in Plate 31. The 16-gallon hot water storage tank is seen in the top centre, with wash-up trough served with hot and cold water taps below and can steaming cabinet to the left. In the right-hand top corner can be seen portion of the can storage accommodation constructed of galvanised iron piping.

The boiler room shown on the plan houses a 2 h.p. boiler which operates at 30 lb. pressure and burns wood. Ample water is available at the shed for all purposes, including stock watering, and trees provide excellent shade.

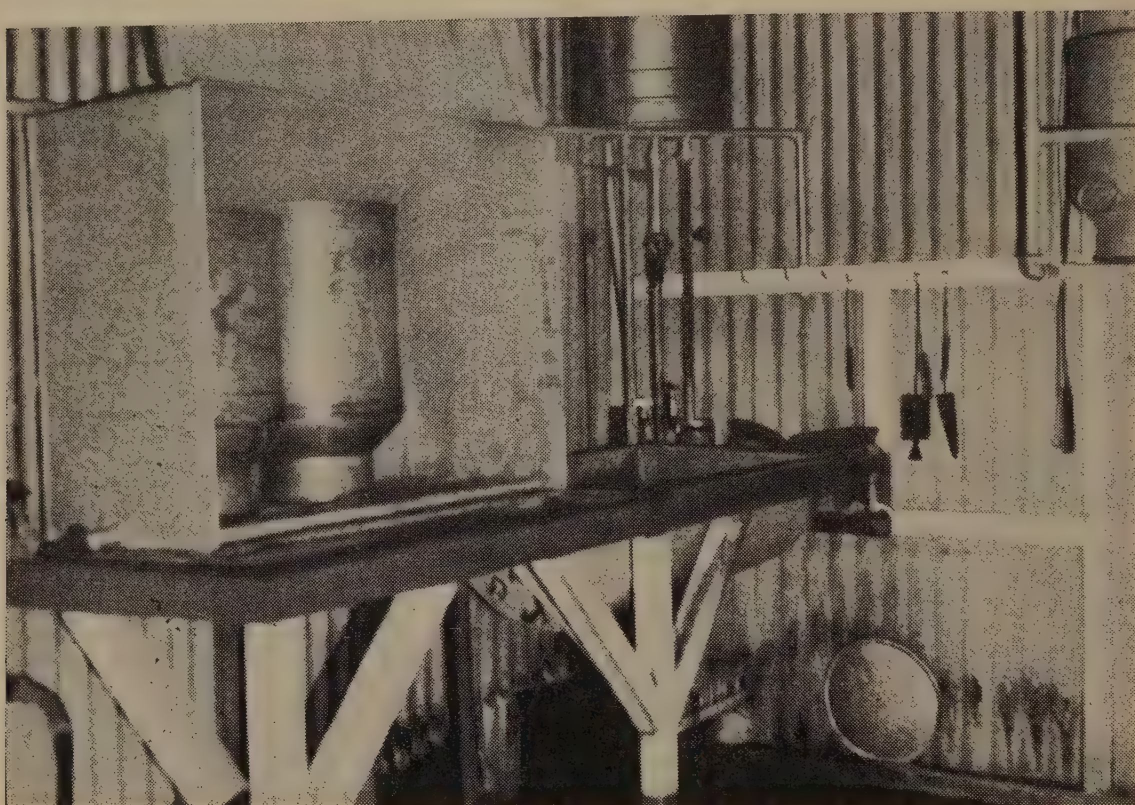


Plate 31.

Wash-up Room—Stollznow Bros., Bundaberg. Note the hot water storage tank at top centre.

The building of the second prize winner is very well constructed of weatherboards and iron and a nicely finished appearance is gained by it being completely lined and ceiled and decorated with ferns, elkhorns, ornaments, &c. Plate 32 gives a general view of the dairy shed. Some of the decorations can be seen in the illustration.

A shallow depression in the inner yard serves as a foot bath for the cows when a plug is placed in position. This is actually portion of the drainage system which continues as a wide, shallow cemented drain to a creek bank some 40 yards from the shed area.

The bails are painted white, with green trimmings, and lead to a concreted exit race. The end walls are cemented and plaster finished to a height of 4 feet 6 inches. Floating dummies are provided. An ornamental iron gate painted green, leading from the bails to the engine room, can be seen in Plate 32.

Equipment includes a three-unit milking machine, an engine which drives a geared eccentric arm operating a plunger type water pump supplying elevated tanks, milk vat, separator, refrigerator, sterilizer, wash-up trough and storage racks.

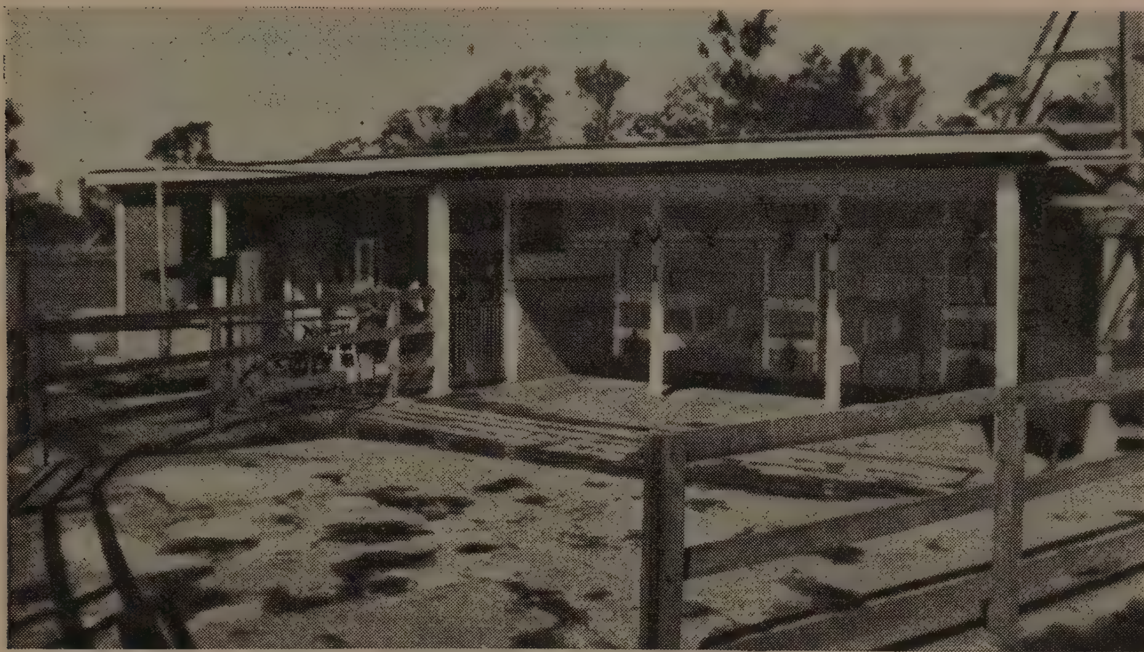


Plate 32.

Shed of Mr. E. M. Powell, Gin Gin.

Ample water is available at the shed but no provision has been made adjacent to the shed area for stock watering.

The shed of Mr. C. G. Luthje is of wooden construction, is built on the slope of a hill and faces north.

Plate 33 shows a four-unit bail area with concreted holding yard and concrete exit steps. The exit area is shown in Plate 34.

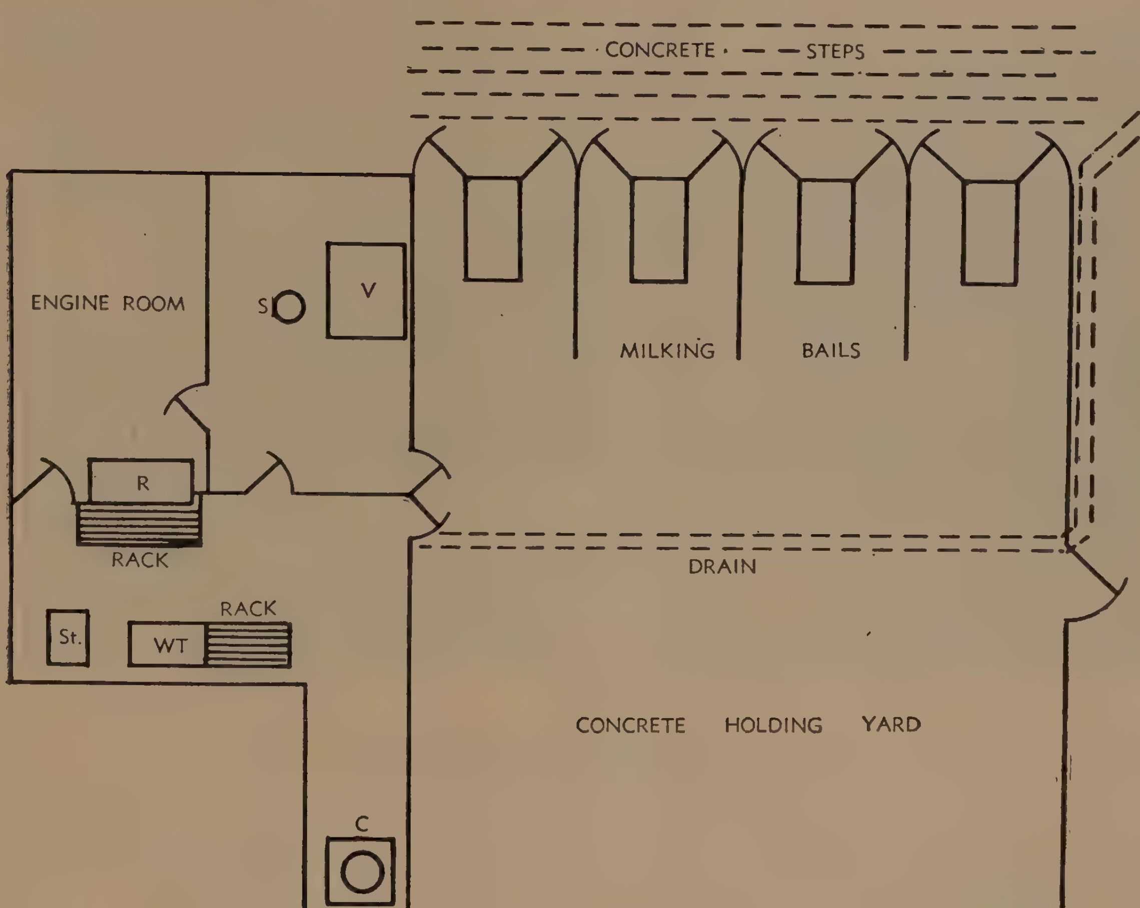


Plate 33.

Layout of Shed of Mr. C. G. Luthje, Monto. C, copper; R, refrigerator; S, separator; St, sterilizer; V, milk vat; WT, wash trough.

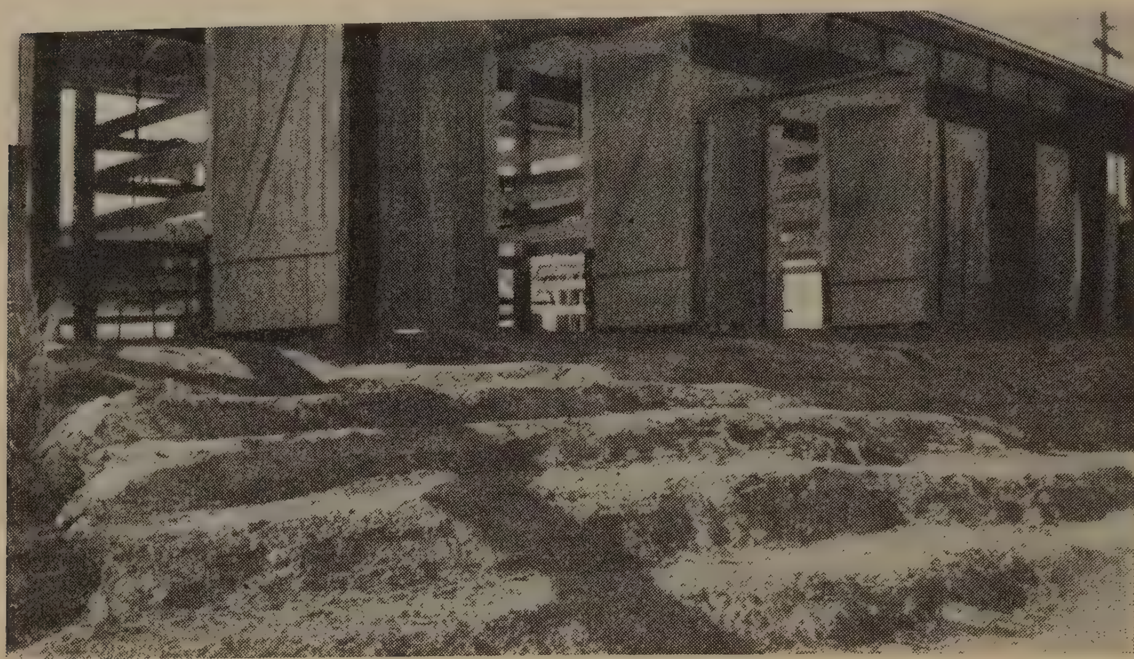


Plate 34.

Exit Area of Cows From Bails—C. G. Luthje, Monto.

No air space is provided and the engine room is further away from the bails than the separator room. The bail end wall is a full cement one, while that at the opposite end is half concrete and the balance T. and G. boards. The bails are painted white above two feet of black paint.

Plate 35 shows a section of the bails, with floating dummies and door handles operated through a support from the roof.

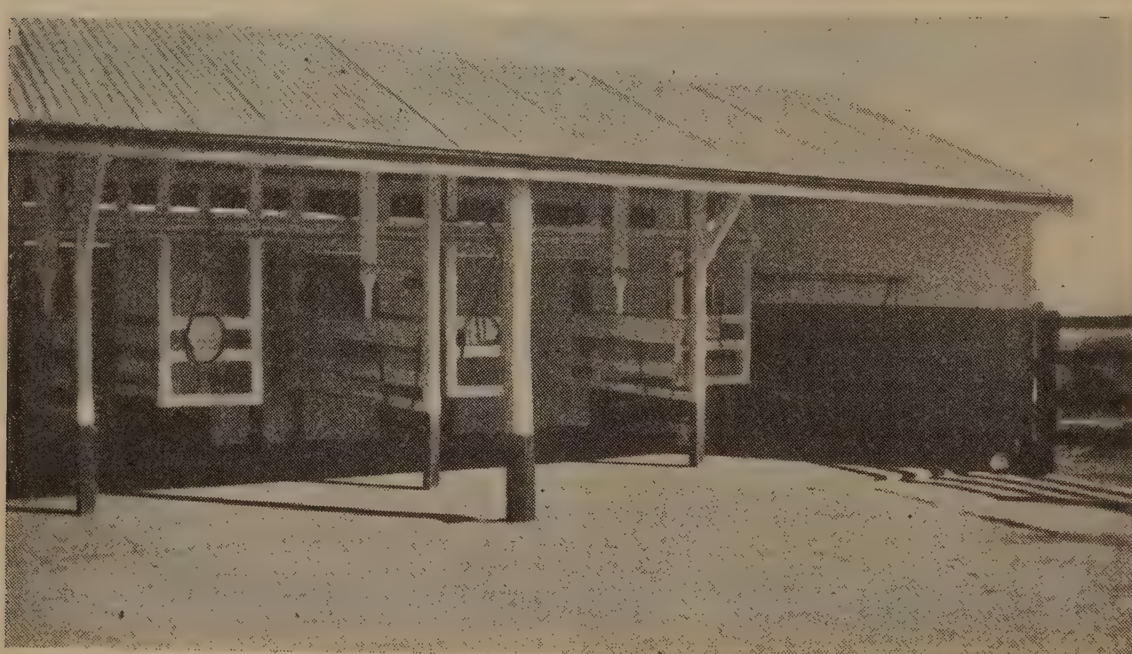


Plate 35.

Section of Bails—C. G. Luthje, Monto.

Equipment includes a four-unit milking machine, engine, sterilizer and refrigerator in addition to milk vat, wash-up trough and storage racks.

Water is stored in two underground cement tanks holding 6,000 gallons and a galvanised 1,000 gallon tank, giving ample storage space. A water trough is available for stock purposes and trees provide shade at the yards.

Zone 6 Prize Winners.

In Zone 6, covering the districts of Dairying Division officers stationed at Rockhampton, Gladstone, Wowan, Biloela and Mackay, much interest was evidenced in the competition and 20 entries were received. The judging was carried out by Senior Dairy Adviser P. McCallum.

Prize winners were:—

	Points.
First—N. D. Hill, Nagoorin, Boyne Valley Line ..	347
Second—W. Menkens and Son, Home Hill	316
Third—R. McE. Bell, Dalrymple Heights, via Mackay	312

The site of the buildings on the property of Mr. Hill is not ideal, but is the best available. The ground is fairly flat and as a consequence natural drainage is not good. The front of the shed faces east and is satisfactory.

The plan (Plate 36) shows the layout of the four-unit shed with concreted exit race and covered holding yard. Ample shade is provided around the shed and a 24 ft. trough supplies water to each of three holding yards.

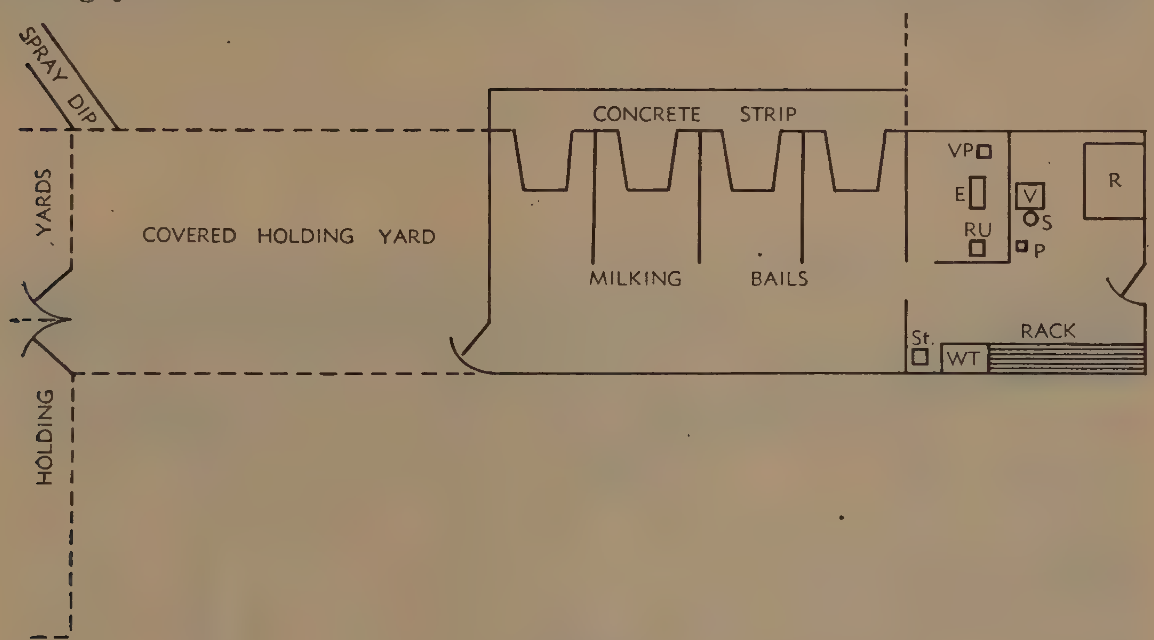


Plate 36.

Layout of Shed of Mr. N. D. Hill, Nagoorin. E, engine; P, pump; R, refrigerator; RU, refrigerator unit; S, separator; St, sterilizer; V, milk vat; VP, vacuum pump; WT, wash trough.

A general view of the premises is shown in Plate 37. The building is a new one and is very solidly constructed of dressed hardwood with roofing of corrugated fibro sheets. The engine and separator rooms are ceiled and painted white. The outside walls of this portion are of a form of stucco attractively painted white. The owner remarks that this type of construction closely approximates the cost of weather-boarding and is much more pleasing to the eye.

The equipment includes a four-unit milking machine, sterilizer, wash-up trough and draining rack, milk vat, separator, skim milk pump, refrigerator and engine. An interesting feature in relation to this lastnamed piece of equipment is the installation of a ½-inch pipe

Plate 37.

General View of Premises—N. D. Hill, Nagoorin.

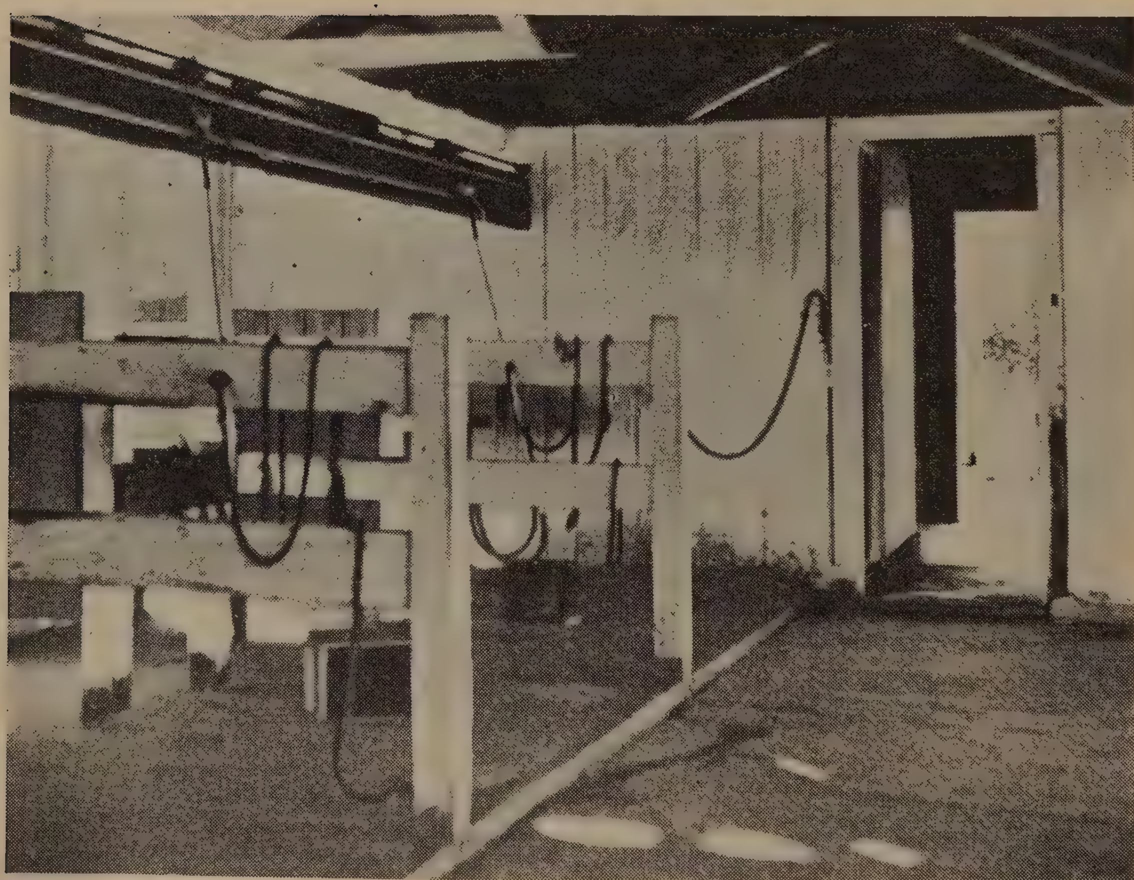


Plate 38.

Section of Bails—N. D. Hill, Nagoorin.

and small float into the engine cooling tank. Mr. Hill considers this a great time saver as he only has to glance at the water level very occasionally.

Plate 38 shows the solid construction of the bails section of the shed. Drainage from the floors is graded to a sump in the first bail and then taken underground to a creek bed about 50 feet from the shed. Water is laid on to the shed at four points from an elevated tank filled from a well. This water is soft and is used for all shed and household purposes.

The second prize winners (Messrs. Menkens and Son) supply whole milk to Home Hill. The ground plan in Plate 39 gives the layout.

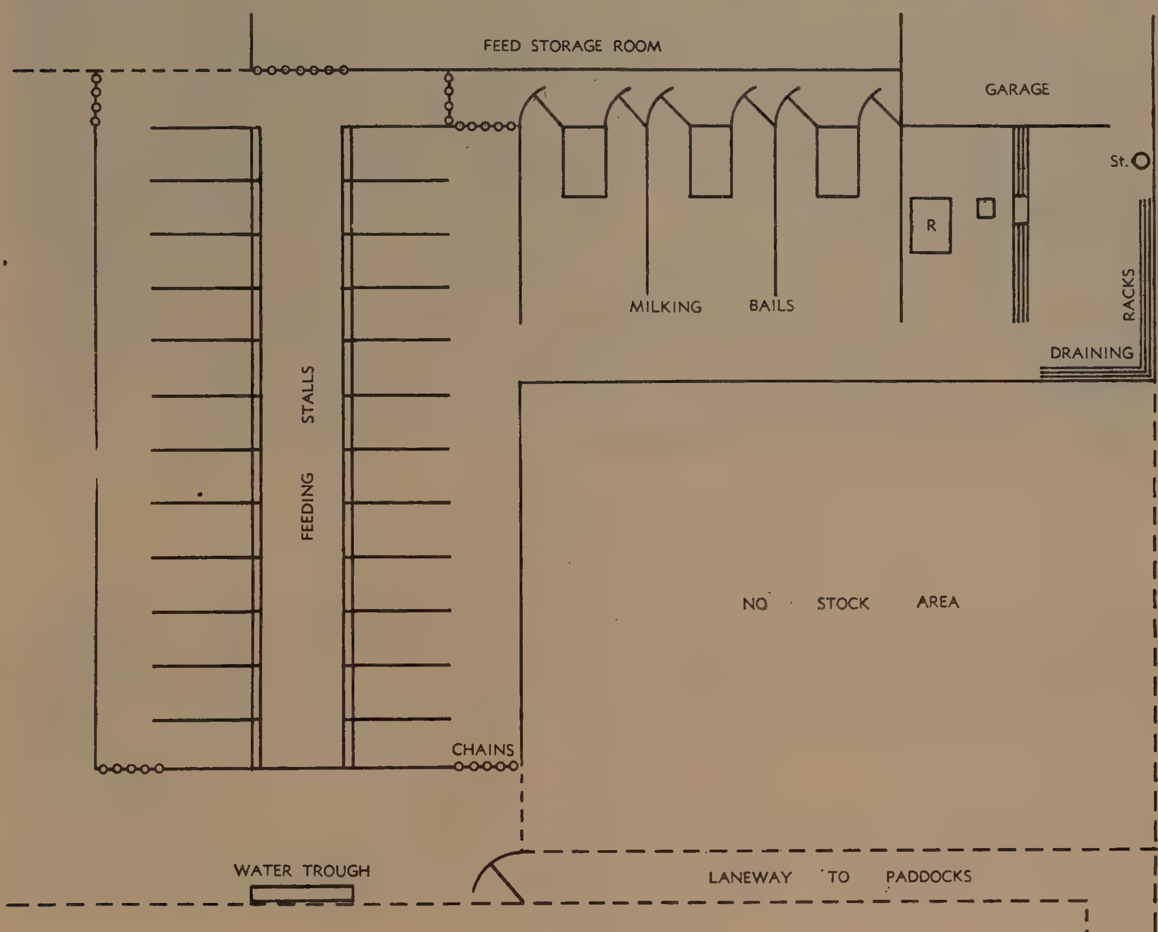


Plate 39.

Layout of Shed of Messrs. Menkens and Sons, Home Hill.
R, refrigerator; St, sterilizer.

The milking shed is constructed of sawn timber mounted on raised concrete walls with a corrugated asbestos cement roof of gable design. The whole shed is painted internally and suspended dummy bails are a feature. As can be seen from the plan, 24 feeding bails are provided. These have a concrete floor as also has the exit race and small holding yard. A water trough is provided for the cattle and a stock-free area keeps stock from the treatment end of the building. Equipment includes a three-unit milking machine, electric motor, sterilizer, milk vat, cooler, all metal draining racks, milk cooler and refrigerator. Two windmills supply water to two 1,500 gallon tanks, from where it is reticulated to the shed, troughs and house.

The dairy shed of the third prize winner is of the walk-through type, very similar to that of Messrs. Menkens and Son, being constructed of sawn timber on dwarf concrete walls and equipped with all modern equipment, including a refrigerator to hold up to nine 8-gallon cans.

Zone 8 Prize Winners.

Zone 8 comprised the districts of Dairying Division officers stationed at Innisfail and Malanda. Only four entries were received and prize winners were:—

	Points.
First—J. F. Evans, Malanda	331
Second—R. S. Griffiths, Moregatta	294
Third—D. E. Beattie, Malanda	289

Judging was carried out by Senior Dairy Adviser L. Moriarty.

The buildings of the first prize winner are very solidly constructed of first class materials. They were erected some seven years ago, and were the first of this type to be built on the Atherton Tableland.

The covered holding yard extends a total of 83 feet from the bail exit. Only portion of this yard is shown in the plan (Plate 40). Even in this very wet area it is considered that a considerably lesser covered area would be sufficient.

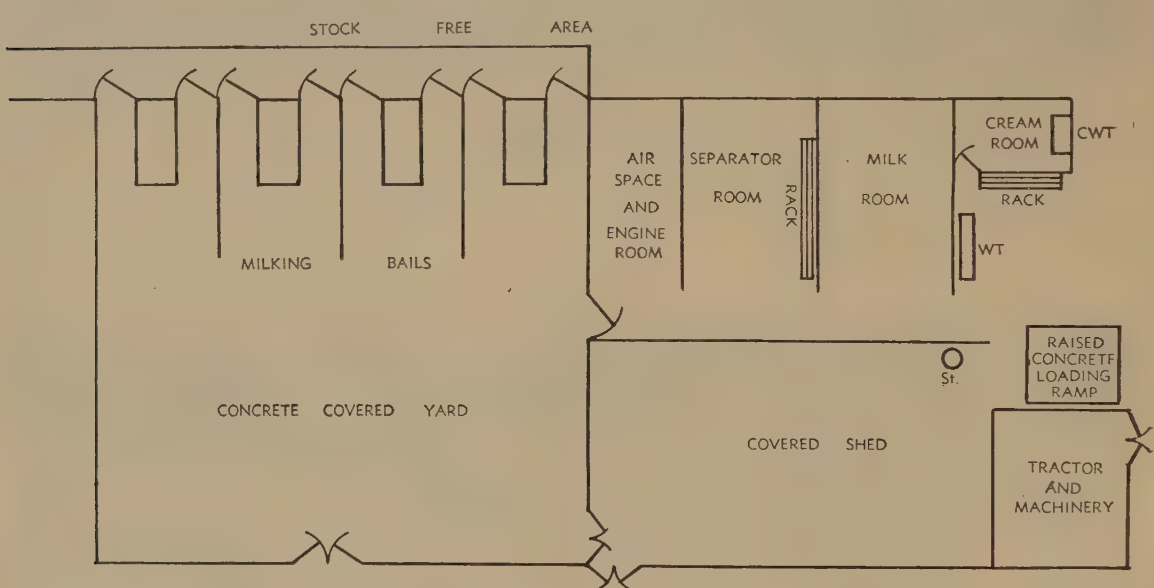


Plate 40.

Layout of the Shed of Mr. J. F. Evans, Malanda. CWT, concrete water trough; St, sterilizer; WT, wash trough.

The whole of the main portion of the building is lined and ceiled and painted.

The walls stand on 18 in. concrete curbings, the dummy bails are suspended, and a water tap is laid on to each bail.

The exit race leads through a crush situated at the opposite end to the milk room, and so the stock are diverted from this area.

The engine room, separator and milk rooms contain all necessary equipment. The cream room contains a concrete water trough for holding and cooling cream awaiting transport. The cans are loaded to the lorry from the concrete loading ramp shown in the plan.

Galvanised iron piping can and equipment drainage racks are provided.

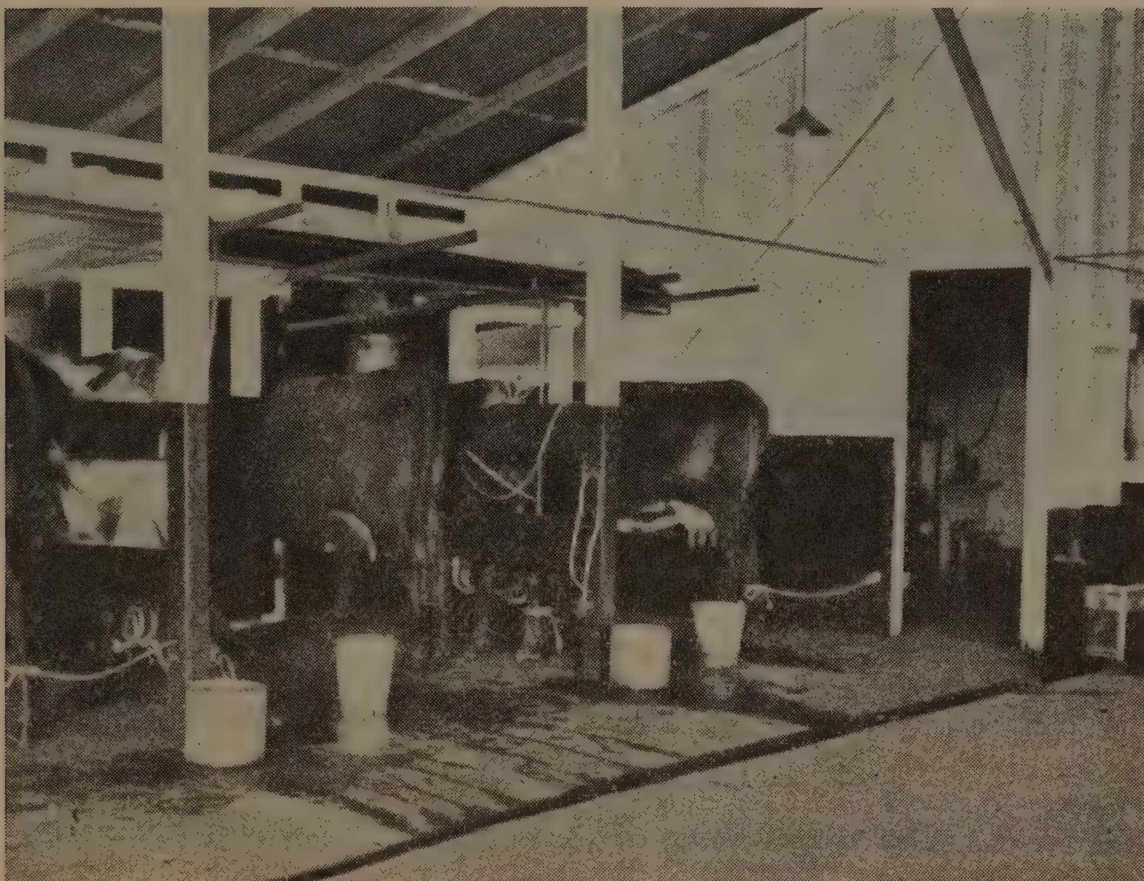


Plate 41.

Section of Bails—Mr. R. S. Griffiths, Moregatta.

The buildings of the second prize winner are of an older design than those of Mr. Evans, but they are maintained in excellent condition. Large areas of concrete surround the entrance and exit of the shed, which has a clean fresh appearance as the result of using tar and white paint.

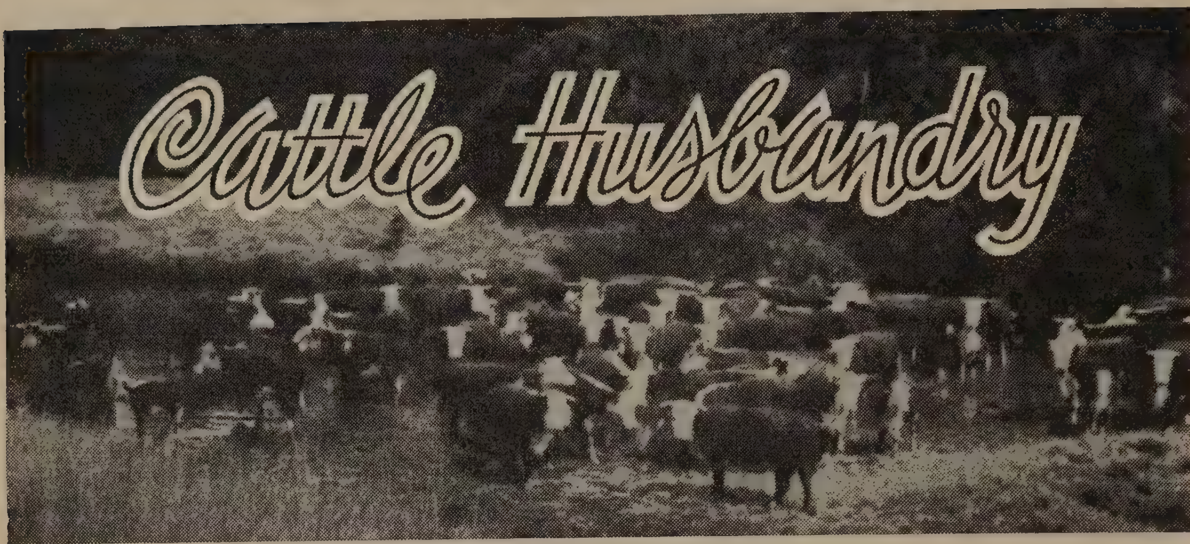
A section of the bails is shown in Plate 41. The equipment is adequate and well maintained. Drainage is good and water is laid on at several points to the shed area.

Director of Dairying on Pakistan Mission.

The Department's Director of Dairying (Mr. E. B. Rice) is spending January and February in Pakistan investigating various aspects of the dairying industry in that country on behalf of the Pakistani Government.

The visit is being made under the technical co-operation programme of the Colombo plan, whereby the Commonwealth Government agreed to render Pakistan all technical aid possible in the development of the country. Mr. Rice, whose services have been made available by the State Government, will report to the Commonwealth Government on the best way of giving technical aid.

The Pakistani Government has asked advice on the most effective ways of avoiding wastage in the collection, storage, transport, processing and marketing of milk and milk products, and Mr. Rice will devote most of his time to these matters.



Progress Results of the Feeding Demonstrations Under the Commonwealth Dairy Industry Efficiency Grant.

G. I. ALEXANDER, Cattle Husbandry Branch.

THE Commonwealth Dairy Industry Efficiency Grant was made available to the States with the object of increasing efficiency and overall production in the dairy industry. One direction in which money from the Grant has been utilized in Queensland is in demonstrating proved or accepted methods of efficient operation in the industry.

In the feeding demonstrations, which are the subject of this article, the aim was to demonstrate the comparative efficiency of various concentrate mixtures as aids to butterfat production when fed to milking cows.

The supplementary feeding schedules were designed to that end. They were based on work originally done in America, where a new outlook on the feeding of dairy cows has been developed. Previously, the main principle was to make certain that the cow had sufficient feed to maintain body weight and then to feed her according to her milk production. This meant that the cow would receive a certain amount of feed for maintenance plus an allowance which varied with her production. As each cow approached maximum production, the increase in milk production due to each pound of feed consumed became less until a point was reached where no further production was achieved by increased feeding. This indicated the highest level of production of which the cow was capable.

The American workers approached the problem not so much from the standpoint of maximum productivity of the cow as from the economics of feeding. They contended that, provided a cow received sufficient good roughage to maintain body weight, there was a point at which she could be fed grain most economically. This was also shown under Australian conditions, where economic returns were achieved by feeding small quantities of grain and protein mixtures. The level of protein in the mixtures was varied according to the season, the higher protein mixture being fed during the dry winter.

In the Queensland demonstration, as each cow was to be fed as an individual, the herds had to be ones under regular test for butterfat so that the results could be used as a basis for the rationing of the cattle. The farms were selected so as to give a representative picture of the feeding problems in the major dairying districts of the State. They were located at Beaudesert, Oakey, Kingaroy, Gympie, Monto and Atherton. This distribution gave an indication of the way in which the feeding practices operated under a wide variety of climatic and seasonal conditions, dairying practices and marketing problems. Two of the districts, Beaudesert and Atherton, respectively supply raw milk to the cities of Brisbane and Townsville. Of the remaining districts, Oakey supplies milk for cheese and the others supply cream to their local butter factories.

Each herd was divided into at least two groups of cows and some into three groups. On the farms where three groups were used, one was a control group not being fed any concentrate mixture at all and the other two were fed a concentrate mixture at different rates. The method of feeding adopted was to ensure that the cow received adequate grass and roughage on the farm for her maintenance and then to feed her according to her test to produce more milk. In rationing the cattle, the assumption was made that the grass and roughage available on the farm were sufficient for the cow's maintenance and for the first gallon of milk produced. All milk was reduced to a uniform 4 per cent. test except in the Beaudesert area, where a test of 3.3 per cent. butterfat was used.

Bearing in mind the fact that feeding a small amount of concentrate was likely to be economical whereas a full allowance was unlikely to be, the concentrate mixtures were fed at various rates ranging from 1 lb. of concentrate for every 3 lb. of milk (4 per cent. butterfat test), over the first 10 lb. milk produced, to 1 lb. of concentrate for every 10 lb. of milk (3.3 per cent. butterfat test). This was to demonstrate the response in milk production to the various rates of feeding as well as to reveal the economics of the various levels.

One of the most important considerations in a cow's production is the protein she receives from the grass. While the grass is young, there is a good protein intake by the grazing cow but this lessens as the grass matures, flowers and seeds. This prompted the use of a number of rations containing various percentages of protein. Grains containing approximately 10 per cent. crude protein were compared with rations with increasing protein percentages up to 40 per cent. crude protein. The following concentrate mixtures are being used:—

(1) Crushed grains (approximately 10 per cent. crude protein).
(2) Grain and linseed meal (approximately 15 per cent. crude protein).
(3) Grain, meatmeal and linseed meal (approximately 20 per cent. crude protein).
(4) Grain and meatmeal (approximately 20 per cent. crude protein).
(5) Grain and meatmeal (approximately 25 per cent. crude protein).
(6) Peanut meal (approximately 40 per cent. crude protein).
(7) Meatmeal and molasses (approximately 25 per cent. crude protein).

All rations used contained 1 per cent. salt and 1 per cent. bonemeal.

The economic aspect of the feeding of these rations is being studied, the cost of feeding each cow being worked out for various prices of the mixture fed and butterfat sold. Milk for feeding calves and pigs is not taken into consideration.

The results achieved to date are by no means conclusive and only a study spread over a number of years will provide the final answer. However, the findings already obtained reveal certain trends which may give an indication of the final result.

The lower rates of feeding have given a considerable lift in production, and in general are more profitable than the higher rates of feeding. Higher rates of feeding have shown an increased production but the extra production obtained has been insufficient to pay for the extra feed consumed, due to the present adverse milk-concentrate price ratio. One herd in the Beaudesert district provided the exception. In this herd, feeding crushed grain at the rate of 1 lb. for each 10 lb. milk was compared with feeding 1 lb. grain for each 5 lb. milk (corrected to 3.3 per cent. test). The higher rate gave increased production and was more profitable than the lower rate. In the Gympie, Kingaroy and Oakey areas, two rates—1 lb. grain for every 3 lb. milk, and 1 lb. grain for every 6 lb. milk (milk corrected to 4 per cent. test)—were compared. In all three areas the higher rate of feeding either gave no increase in production at all or gave such a slight increase that it failed to justify feeding the additional grain. From these results, it could be inferred that the optimum level of grain feeding is in the vicinity of 1 lb. crushed grain for every 6 lb. of milk (corrected to 4 per cent. butterfat).

The comparison between the various levels of protein feeding was undertaken as a means of showing the relative efficiency of utilization at the various levels of protein intake. On a number of farms, a comparison was made of the effect of feeding crushed grains alone and crushed grains plus meatmeal. The former ration contained 10 per cent. crude protein and the latter 25 per cent. crude protein. There was either no difference in production in the two groups or the increase was so small as to be of little consequence. When grain alone was compared with a 20 per cent. protein mixture, the difference in production in the two groups was somewhat greater. When crushed grain alone was compared with a 15 per cent. protein mixture, the difference in the two groups was of about the same order as in the case of grain versus 20 per cent. protein mixture. It would appear from this that a level of protein in the concentrate supplement somewhere between 15 per cent. and 20 per cent. is best.

A comparison of the rate of feeding the high protein mixtures indicated that 1 lb. concentrate for every 5 or 6 lb. milk (corrected to 4 per cent. butterfat test) was about the best.

Plates 42 and 43 are two graphs taken from two herds showing the relative efficiency of the high and low rates of grain feeding and grain and grain plus meatmeal (20 per cent. crude protein).

The results detailed above were obtained during 1950, which was a very good season in every district in the demonstration. It is quite possible that, because of the influence of excellent pastures, the results obtained may not hold for less bounteous seasons. It will be interesting to compare results for 1951 with those obtained last year.

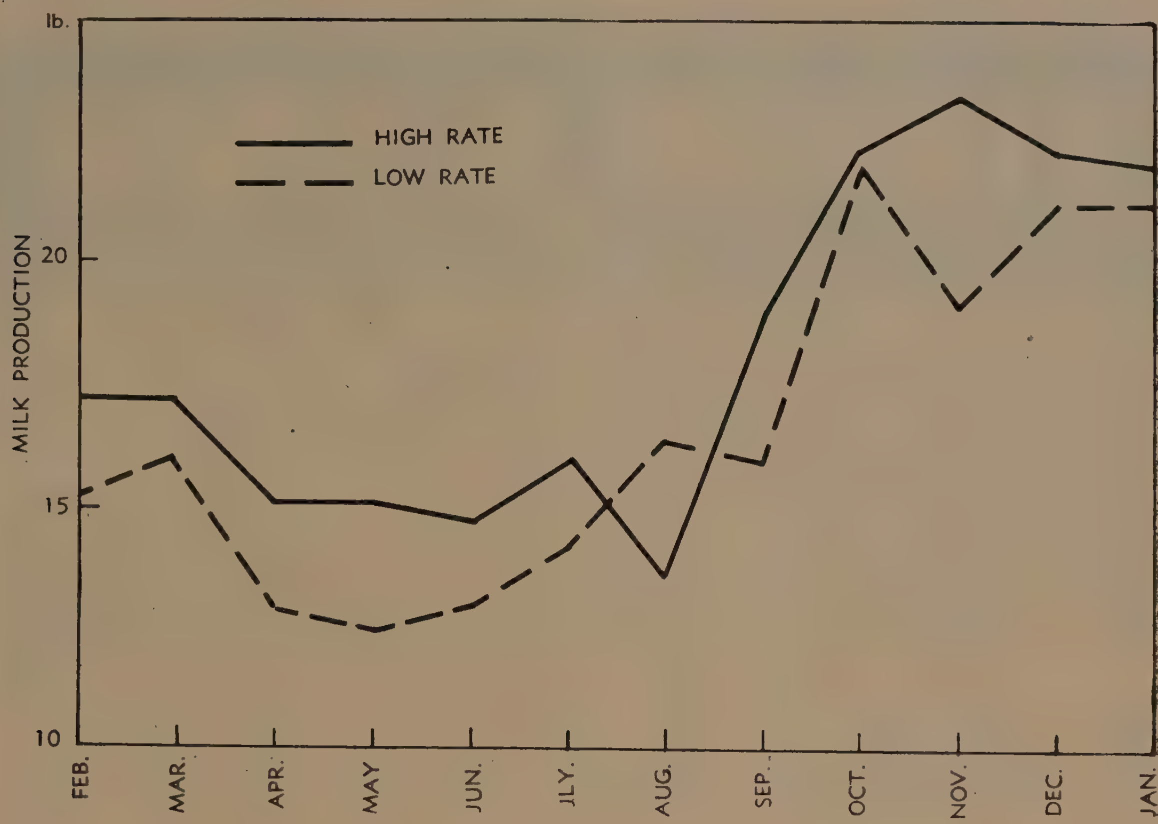


Plate 42.

Graph Showing Average Monthly Milk Production of a Herd Receiving Crushed Grains at the Rates of 1 lb. per 3 lb. Milk and 1 lb. per 6 lb. Milk.

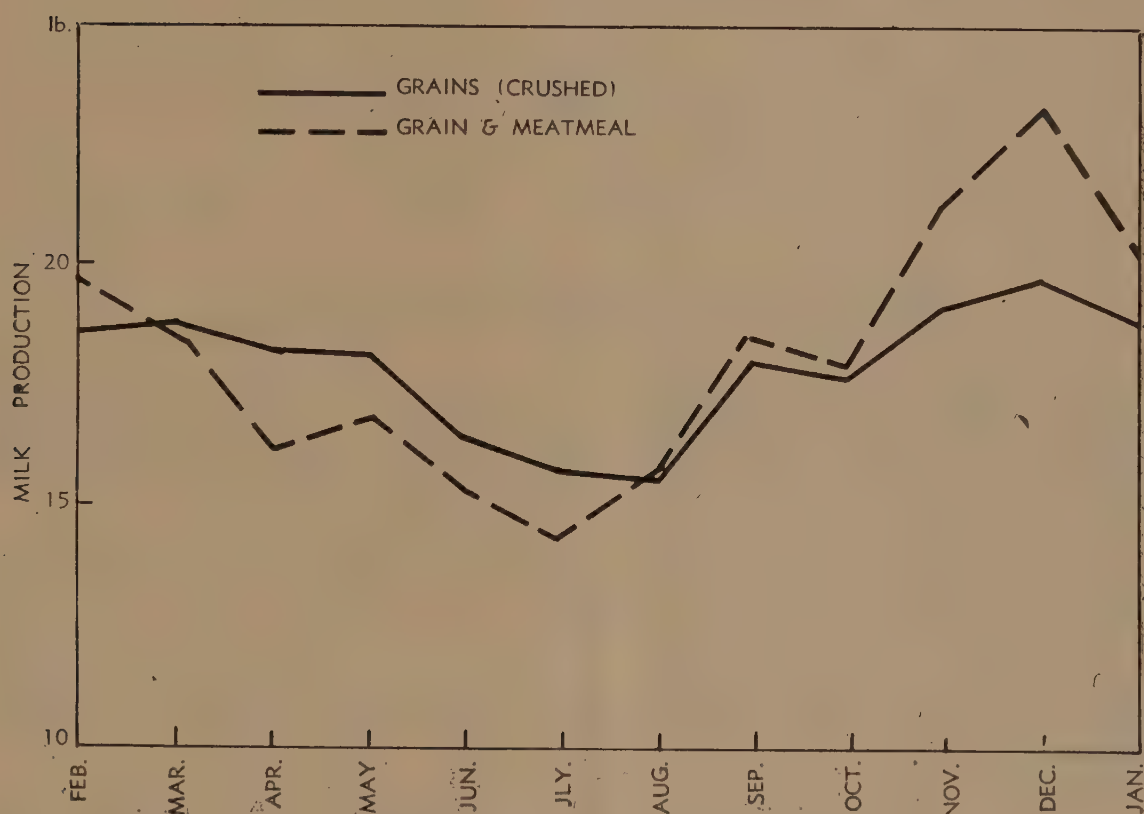


Plate 43.

Graph Showing Average Monthly Production of a Herd Receiving Crushed Grains and a Grain and Meatmeal Mixture (20 per cent. crude protein) at the Rate of 1 lb. per 5 lb. Milk.

The method of rationing used for the feeding demonstration can be easily applied to any herd undergoing herd recording. When the herd record sheet is received by the owner of the herd he may apply the rationing system by converting the daily amount of milk produced by each cow to 4 per cent. butterfat test. Having done this, he then subtracts the first 10 lb. of milk and rations the cow according to the balance of 4 per cent. milk.

An alternative method, which is much easier to apply, is to ration according to the amount of butterfat produced. This eliminates the necessity of converting to 4 per cent. butterfat test. By this method, .40 lb. butterfat is subtracted from the daily butterfat listed. The cow is rationed on the remaining butterfat. For this method a list of rationing scales is listed below:—

1 lb. meal per 10 lb. 4 per cent. milk	=	1 lb. meal per .40 lb. butterfat
1 lb. meal per 9 lb. 4 per cent. milk	=	1 lb. meal per .36 lb. butterfat
1 lb. meal per 8 lb. 4 per cent. milk	=	1 lb. meal per .32 lb. butterfat
1 lb. meal per 7 lb. 4 per cent. milk	=	1 lb. meal per .28 lb. butterfat
1 lb. meal per 6 lb. 4 per cent. milk	=	1 lb. meal per .24 lb. butterfat
1 lb. meal per 5 lb. 4 per cent. milk	=	1 lb. meal per .20 lb. butterfat
1 lb. meal per 4 lb. 4 per cent. milk	=	1 lb. meal per .16 lb. butterfat
1 lb. meal per 3 lb. 4 per cent. milk	=	1 lb. meal per .12 lb. butterfat

An example of the application of this method is:—On the Herd Recording Sheet, Mintie gave .74 lb. butterfat on the day of test. Subtracting the initial .40 lb. butterfat, a remaining .34 lb. butterfat is left on which the cow is rationed. If feeding at the equivalent to the rate of 1 lb. meal for every 6 lb. of 4 per cent. milk, then she should receive 1.5 lb. meal daily.

Birdsville Horse Disease Outbreaks.

The Department's Division of Animal Industry reports that serious outbreaks of Birdsville disease have occurred during recent months in station horses and brumbies in the area extending southwards from Cloncurry to the South Australian border.

In some districts the entire horse population has been affected, bringing stock work to a standstill.

Investigations carried out by the Department in 1948 and 1949 led to the deduction that the disease is caused by horses eating a common weed named *Indigofera enneaphylla*. This deduction has since been fully confirmed.

There is no known cure for the disease, so it is essential to prevent horses from eating the weed if losses are to be avoided. On properties where the plant is so widespread that a paddock free from it cannot be found, some owners have been forced to hand-feed working horses to prevent losses.

ANIMAL HEALTH

Veterinary Medicines.

F. B. COLEMAN, Registrar of Veterinary Medicines.

VETERINARY medicines under *The Veterinary Medicines Acts*, 1933 *to* 1938, include any mixture, compound, or preparation of one or more drugs or ingredients in any form or any biological products, including both living and dead vaccines, sera, and diagnostic agents intended to be administered to stock by any means.

(*a*) For the purpose of curing or alleviating any injury to stock,

(*b*) For the purpose of curing or preventing any disease of any stock,

(*c*) For the purpose of improving the conditions of or increasing the capacity of any stock for work or production or show purposes.

The term does not include—

(i.) Any drug or drugs actually prescribed by a veterinary surgeon in the course of the practice of his profession as such;

(ii.) Any veterinary medicine or medicament or material supplied by a veterinary surgeon for any stock for the time being under his professional care or charge.

Every dealer in veterinary medicines must hold a license to sell such preparations. The prescribed license fee is 5s. which is payable in January of each year and/or when commencing business.

Before any veterinary medicine is placed upon the Queensland market, an application for registration must be made and such application renewed every three years (that is, 1951, 1954, &c.) during the month of January. Registration fees are payable annually. No sales should take place until registration has been effected.

Application for registration or renewal thereof involves the forwarding of a statutory declaration, setting out the formula of the preparation, accompanied by a specimen label and sample, and the necessary fees (£1 1s. for the first preparation, and 5s. for each subsequent veterinary medicine, with a maximum of £5 5s. per year). These applications are duly examined with respect to the Acts' requirements and placed before the Veterinary Medicines Board—consisting of the Agricultural Chemist, Chief Inspector of Stock, a bacteriologist, and a veterinary surgeon.

The formulae, claims, and statements made are considered, and, if approved, the veterinary medicine upon completion of all the Acts' requirements, is duly registered.

All labels are required to set out the following:—

(*a*) The distinctive name of the veterinary medicine;

(*b*) The net weight contained in the package, or, in the case of liquids, the true volume content expressed in Imperial measure;

(*c*) In the case of any liquid veterinary medicine having or claiming to have germicidal and/or disinfecting properties, its bactericidal efficiency expressed in terms of absolute phenol (100 per cent.) as determined by the Rideal-Walker test;

(*d*) A printed statement giving quantity or proportion of any substance or substances prescribed in the Second Schedule of the Regulations;

(*e*) In the case of biological products, in addition to the other requirements of the Regulations, the date from which they should no longer be used; this must be expressed in the following manner:—

"Kept in a dark, cool place, this product remains fully potent until (*here insert date*)."

(*f*) The name and address of the Queensland primary dealer or manufacturer;

(*g*) All directions for use of the veterinary medicine;

(*h*) The following wording:—

"Registered under the Queensland Veterinary Medicines Acts";

(*i*) The word POISON when required.

All veterinary medicines containing Carbon tetrachloride, Tetrachlorethylene, and Trichlorethylene, must be labelled "Poison" and packed in the manner prescribed by Regulation 15 under the Veterinary Medicines Acts.

The word "POISON" should be in red letters on a white ground, in larger and heavier type than any other letter on the label; and no other word shall appear on the same line. No other letter on the label shall be in a red colour.

Farmers and other buyers would be well advised never to accept delivery of any veterinary medicine unless it has affixed to the package a plainly printed label setting out the required information.

In the absence of a label it is obvious that the buyer should at once communicate with the Standards Branch, Department of Agriculture and Stock, William Street, Brisbane.

The Veterinary Medicines Acts provide that no person shall affix any label to or use or issue with or in connection with any veterinary medicine offered for sale directions for use, or any printed, typed, or written matter, and/or advertisement which contains any statement or claim which directly or by implication indicates or suggests that it will prevent or cure the following diseases:—

Malignant growths (cancer), tuberculosis, or contagious abortion.

The veterinary medicines as set out in the following list are those that have been registered for the three-year period January, 1951, to December, 1953, under the above Acts. These and any published in subsequent lists are the only veterinary medicines that should be offered for sale or requested by prospective purchasers.

It should be noted that the sale of any unregistered veterinary medicine would render the seller liable to a penalty not exceeding £20.

Veterinary Medicines Registered for the Period January, 1951 to December, 1953.

List No. 1 published on 7th December, 1951.

A.C.F. & Shirleys Fertilizers Ltd., Little Roma Street, Brisbane.

Sodium Fluoride
Farran Maspen 25
Farran Maspen 40
Penstix

Australian Chemical Co. Pty. Ltd., 305 Montague Road, South Brisbane.

Savol

Australian Mercantile Land & Finance Co. Ltd., 129-137 Creek Street, Brisbane.

"Amco" Phenothiazine

Baynes, J. H., 297 Ruthven Street, Toowoomba.

Hamilton Mammitis Vaccine
Pro-Vet Antiseptic Capsules
Pro-Vet Blackleggine
Pro-Vet Black Spot Application
Pro-Vet Blighty
Pro-Vet Bloat Draught
Pro-Vet Bot Bombs
Pro-Vet Calcium Drench
Pro-Vet Embrocation for Horses, Cattle and Dogs
Pro-Vet Foot-Rot Paste
Provetine
Provet-ol
Pro-Vet Stock Drench (Concentrated)
Pro-Vet Salve
Pro-Vet Scour Treatment
Pro-Vet Udderlin
Pro-Vet Vaginitis Powder

Bickford, A. M. & Sons Ltd., Tank Street, Brisbane.

B.R. Bone Radiol for Horses, Cattle and Dogs
Radiol Chemical Liquid
Radiol Leg Wash Powder

Blaiklock, H. & Co. Pty. Ltd., Eagle Farm Road, Hamilton, Brisbane.

Calcium Borogluconate
Safonia
Wagstaff's Fluke and Stomach Worm Drench
Wagstaff's Stock Drench
Wagstaff's Tapeworm Drench for Sheep (Double Strength)

Bryce Ltd., Ann Street, Brisbane.

Pegasol
Pegasus Blackleg Aggressin (Liquid)
Pegasus Dairy Ointment
Pegasus Eye Powder
Pegasus Mammitis Toxiculture
Pegasus Stock Drench (Concentrated) for Horses, Cattle, Sheep, Pigs
Pegasus Vaginitis Capsules
Pegasus Worm Drench for Horses
Pegavo

Butler, E. & Co. Pty. Ltd., 432 Queen Street, Brisbane.

Hagley's Hopple Chafe Lotion

Campbell Bros. Pty. Ltd., Campbell Street, Bowen Hills, Brisbane.

Safa

Cowper, F. A., Rep. Parke Davis & Co., 72 Gracemere Street, Grange, Brisbane.

Arecoline Hydrobromide (Tablets)
Equine Cough Syrup (Veterinary)

Dalgety & Co. Ltd., Elizabeth Street, Brisbane.

Kerol
Quibell's Liquid Farm and Station Disinfectant

David Pharmacies, 265-7 George Street, Brisbane.

Fleego Dog Soap
K-Nine Canker Lotion
K-Nine Ear Canker Powder
K-Nine Puppy Worm Syrup
K-Nine Worm Mixture for Grown Dogs
Rid-O-Mange

Dryden, V., 10 Fuller Street, Lutwyche, Brisbane.

Gall Ointment for Horses and Cattle
Victor Dryden's Diuretic Powders for Horses and Cattle
Victor Dryden's Embrocation for Horses and Cattle
Victor Dryden's Gripe Drench for Horses and Cattle
Victor Dryden's Liquid Blister for Horses and Cattle
Victor Dryden's Poultry Specific for the Cure of Warts on Poultry
Victor Dryden's Remedy for Scour in Calves
Victor Dryden's Wound Dressing for Horses and Cattle

Embelton, G. P. & Co. Pty. Ltd., 196-8 Boundary Street, Petrie Bight, Brisbane.

A.P.L. Hormo
Solvitax Cod Liver Oil

Faulding, F. H. & Co. Ltd., 200 Charlotte Street, Brisbane.

Phoenix Procaine Penicillin for Mastitis (Veterinary)

Fawns & McAllan, 30 Albert Street, Brisbane.

Oestrogenine brand of Di-Hydro-Stilboestrol

Goldsbrough Mort & Co. Ltd., 63-71 Eagle Street, Brisbane.

Phenomort Liquid Phenothiazine
Vita-Lick To-Cu-Sul Sheep Drench
Vita-Lick Bluestone and Arsenic Sheep Drench

Gollin & Co. Pty. Ltd., 70-72 Eagle Street, Brisbane.

Meggitt's Pure Medicinal Linseed Oil

Grazcos Co-op. Ltd., Corner Adelaide and Creek Streets, Brisbane.

B.N.S. Bluestone Nicotine Sulphate
Grazcos Double Strength Carbon Tet. Drench for Worms and Fluke
Grazcos Sodium Fluoride Treatment for Pigs
Grazcos Worm Capsules (Medium to Large Dogs)
Grazcos Worm Capsules (Terriers and Small Dogs)

Happidog Store Pty. Ltd., 450 Queen Street, Brisbane.

Happidog Canker Lotion
Happidog Canker Powder
Happidog Eczema Lotion
Happidog Eye Ointment
Happidog Skin Lotion
Happidog Worm Powder
Happidog Worm Syrup

Harveyson, T. C., Rep. Burroughs Wellcome & Co. (Aust.) Ltd., "Mildura," Dorrington Drive, Ashgrove, Brisbane.

Banocide Brand Diethyl Carbamazine (Veterinary)
Dermynox Brand bis-Butyl Xanthogen in Oil (Veterinary)
Implantin Brand Stilboestrol Pure (Veterinary)
Infundin Brand Pituitary (Posterior Lobe) Extract
Lutormone
Pentaflav Brand Bull Cones
Pentaflav Brand Veterinary Pessaries
Piroparv Brand (Veterinary)
Stilbecide Brand Veterinary Pessaries
"Sudermox" Mesulphen Emulsion (Veterinary)
Tabloid Brand Tenoban (Veterinary)
"Wellcome" Brand C. Pyogenes Toxoid (Veterinary)
"Wellcome" Brand Injection of Carbachol (Veterinary)
"Wellcome" Brand Injection of Stilboestrol Dipropionate (Veterinary)
"Wellcome" Brand Injection of Sulphanilamide L.S.F. (Veterinary)
"Wellcome" Brand Ringworm Ointment (Veterinary)
"Wellcome" Brand Calcium Borogluconate (Veterinary)
"Wellcome" Brand Solution of Procaine and Adrenaline (Veterinary)
"Wellcome" Brand Solution of Stilboestrol in Oil (Veterinary)
"Wellcome" Brand Staphylococcus Toxoid (Veterinary)
Sulphanilamide B.P. "B.W. & Co." Powder

Hayes Veterinary Co., 351 Queen Street, Brisbane.

Havcol
Hayes' Cattle Blight Powders

Imperial Chemical Industries of Aust. & N.Z. Ltd., 363 Adelaide Street, Brisbane.

"Avlothane" Brand of Hexachloroethane Dispersible Powder
Babesan
C.B.G. Calcium Borogluconate
Gammexane A.P.
Phenovis Powder
Phenovis Tablets
Sulphamezathine brand of Sulphadimethylpyrimidine Sodium Solution

Jackson & Co. (Produce & Seeds) Pty. Ltd., J., Roma Street, Brisbane.

Avol Vitamin "A" and "D_3" Poultry Emulsion

Juratowitch, J. L., Rep. Abbott Laboratories (Aust.) Pty. Ltd., 99 Stanley Street, South Brisbane.

Nembutal Sodium

Leggo & Co. Pty. Ltd., A. Victor, 185 Mary Street, Brisbane.

"Vallo" Nicotine Sulphate

Lock, F. W., 25th Avenue, Sandgate, Brisbane.

Vamatrol

Maclean Pty. Ltd., D., 119 Charlotte Street, Brisbane.

Baxter's Blue Diuretic Tablets
Baxter's Husk Mixture
Baxter's Red Alterative Pills
Baxter's Skin Lotion
Baxter's White Aperient Pills
Baxter's Worm Powders for all Dogs
Baxter's No. 1 Worm Capsules
Baxter's No. 2 Worm Capsules
Baxter's No. 3 Worm Capsules
Baxter's 321 Tablets
Judge's Blight Lotion
Judge's Blight Powder
Judge's Bot Bombs
Judge's Colic & Gripe Drench
Judge's Cough and Cold Remedy
Judge's Dairy Ointment
Judge's Foot Rot Powder
Judge's Mange Oil
Judge's Nasal Ointment
Judge's Physic Balls
Judge's Purgative Drench
Judge's Purple Paint
Judge's Scarlet Blister
Judge's Scour Powder
Judge's Special Horse Laxative
Judge's Vaginal Pessaries
Judge's Vaginitis Powder
Judge's Veterinary Embrocation
Judge's Vettoll
Judge's Wart Ointment
Judge's Worm Powder
"Judsol"
Vitaforce

Mactaggarts Primary Producers Co-op. Assn. Ltd., Eagle Street, Brisbane.

Blackleg Bacterin (Blacklegol)
Equinoint
Mactaggarts' Carbol
"Mactaggarts" Medicated Speying Tar
"Max-Tar" Dehorning Dressing

McDonald & Co., A. H., 99-103 Mary Street, Brisbane.

Vetamac A.B.C. Sheep Drench
Vetamac Antiseptic Tabs
Vetamac Bluestone Nicotine Worm Drench
Vetamac Calcium Borogluconate
Vetamac Calcium Drench
Vetamac Calf Dehorning Fluid
Vetamac C.B.G. Solution (Improved)
Vetamac Dairy Salve
Vetamac Embrocation
Vetamac Fluke Drench 40 per cent. Carbon Tetrachloride
Vetamac Fluke and Worm Specific
Vetamac Foot Rot Cure No. 1
Vetamac Iodine Tincture
Vetamac Ointment
Vetamac Phenothiazine Emulsion
Vetamac Phenothiazine Powder
Vetamac Pine Oil Antiseptic
Vetamac Pig Drench
Vetamac Pink Eye Powder
Vetamac Stock Drench
Vetamac Sulphanilamide Emulsion
Vetamac Tapeworm Drench
Vetamac Vaginitis Powder
Vetamac Vitamin Oil

Madin & Pattison, 346 Queen Street, Brisbane.

Lane's Nicotine Bluestone Drench
Lane's Phenothiazine Drench Powder

Milking Machine Supplies Pty Ltd., 330-332 Adelaide Street, Brisbane.

Buchanan's Antiseptic Capsules
Buchanan's Blackleg Vaccine
Buchanan's Farmers Friend Mammitis Vaccine
Buchanan's Foot Rot Paste
Buchanan's Pink Eye Treatment
Buchanan's Salve
Buchanan's (Concentrated) Stock Drench
Buchanan's Trexol
Buchanan's Worm Powder for Pigs

Mitchell Agencies Pty. Ltd., Kenneth, 78-80 Eagle Street, Brisbane.

Barko Alterative Mixture
Barko Dog Laxative Powders
Barko Ear Lotion
Barko Ear Powder
Barko Eye Lotion
Barko Eye Ointment
Barko Iodine Dog Soap
Barko No. 1 Mixture
Barko Pad Paint
Barko Skin Lotion
Barko Tonic Food
Barko Worm Powders

Morden Laboratories, 66 Charlotte Street, Brisbane.

Chemist Roush Cough Mixture for Dogs
Chemist Roush Dog Tonic
Chemist Roush Ear Drops for Dogs
Chemist Roush Mange Lotion
Chemist Roush No. 408 Tablets for Dogs
Chemist Roush Poultry Medicine No. 16
Chemist Roush Puppy Tape Worm Syrup
Chemist Roush Scaly Leg Ointment for Poultry
Chemist Roush Sulphatabs for Poultry
Chemist Roush Tonic Powders for Dogs
Chemist Roush Worm Capsules for Dogs A
Chemist Roush Worm Capsules for Dogs B
Electron Worm Killer for Poultry
Morden Vitopet Tablets for Dogs and Cats

New Zealand Loan & Mercantile Agency Co. Ltd., Eagle Street, Brisbane.

AHP Zealone Sheep Drench for Stomach Worm and Fluke
Coopazine Phenothiazine Worm Drench
Cooper's Antiseptic Powder
Cooper's Dairy Ointment
Cooper's N.C. Sheep Worm Drench
Kur-Mange

Nicholas Pty. Ltd., 70-72 Eagle Street, Brisbane.

Mastics
Ribon
Sulpha-G
Vetemul Blue Label
Vetemul Brown Label
Vetemul Green Label

Noble & Gegg, W. A., 413 Ruthven Street, Toowoomba.

Nobles Aperient Pills for Large Dogs
Nobles Aperient Pills for Small Dogs
Nobles Blight Lotion for Cattle, Horses and Sheep
Nobles Canker Lotion
Nobles Colic and Gripe Drench
Nobles Foot Rot Powder
Nobles Lavender Paint
Nobles Mange Oil
Nobles No. 11 Worm Capsules
Nobles Non-Irritant Fluid Blister
Nobles Pink Powder for Blight
Nobles Pink Powder for Blight with Sulphanilamide
Nobles Powder for Vaginitis
Nobles Red Blister
Nobles Scour Remedy for Calves
Nobles Wart Ointment for Poultry
Nobles Worm Specific for Puppies
Nobles Vettoll

Nobles Pty. Ltd., Corner Eagle and Charlotte Streets, Brisbane.

Sykes's Animal Colic Compound
Sykes's Animol
Sykes's Bag Balm
Sykes's Contagious Vaginitis Ointment
Sykes's Creatol
Sykes's Drench
Sykes's Farm and Home Embrocation
Sykes's Germ Killer
Sykes Metratone
Sykes Pedicure

Norris Agencies Pty. Ltd., 639 Ann Street, Brisbane.

Sidolia Germicide
C. N. Disinfectant

Northern Veterinary Remedies, Flinders Street, Townsville.

Leghorn Scaly Leg Ointment
Wonderdog Cough Mixture
Wonderdog Dicalcphos Bone Powder
Wonderdog Ear Canker Powder
Wonderdog Mange Ointment
Wonderdog Puppy Worm Syrup
Wonderdog Skin Lotion
Wonderdog Special Formula Tablets
Wonderdog Tonic Tablets
Wonderdog Worm Powders
Wonderdog Vitaminised Tonic Food

Nyal Co. (A. Light, Rep.), c/- Frederick Stearns & Co. Division, Corner Florence and Chermside Streets, Teneriffe, Brisbane.

Krect Mange Lotion
Krect Puppy Worm Syrup
Krect Worm Capsules No. 1
Krect Worm Capsules No. 2
Krect Worm Capsules No. 3
Krect Worm Powders
Krect Veterinary Ointment

O'Meara, T. R., 24 Power Street, West Bundaberg.

Ell-i-Vita Stock Food

Osmond & Sons (Aust.) Pty. Ltd., 500 Stanley Street, South Brisbane.

Bronkos Cough Paste for Horses and Cattle
Osmonds Antiseptic Pessaries
Osmonds Aphrodisiac Powders
Osmonds Black Oils
Osmonds Blister
Osmonds Bot Capsules
Osmonds Brown Draught
Osmonds Chlorosyl
Osmonds Compound Santonin Worm Powders for Pigs
Osmonds Ethodyne
Osmonds Foot Rot Bath Powder
Osmonds Foot Rot Paste
Osmonds Grease Wash
Osmonds Hooseiline
Osmonds Lincolnshire Red Draught
Osmonds Maxadol ''A''
Osmonds Maxadol ''A and D_3''
Osmonds Nikop
Osmonds Physic Balls
Osmonds Pig Powders
Osmonds Restoral
Osmonds Saltona
Osmonds Special Scour Cordial
Osmonds Special Worm Drink for Horses
Osmonds Vaccadyne
Osmonds White Oils or Newmarket Embrocation
Osmonds Worm Drench and Fluke Kill (Single Strength)
Osmonds Worm Drench and Fluke Kill (Double Strength)
Osmonds Zenos Fluid Disinfectant
Wormit Lamb and Hoggett Worm Drench

Piddington & Co., Marshall Street, Goondiwindi.

AHP Carbon Tetrachloride Double Strength Sheep Drench
AHP Sheep Drench
AHP Nicotine and Bluestone Sheep Drench

Pilcher, E. S., 68 Albert Street, Brisbane.

AHP Ascarol
AHP Flurin
AHP Mezathol
AHP Quinoxol

Poultry Farmers Co-op. Society Ltd., Roma Street, Brisbane.

L. Hart's Tick Fever Vaccine (Spirochaetosis)
''Red Comb'' Eye Roup Treatment
''Red Comb'' Fowl Pox Vaccine
''Red Comb'' Healo
''Red Comb'' Kamala Capsules
''Red Comb'' Merazine
''Red Comb'' Nicotine Sulphate
''Red Comb'' Phenothiazine
''Red Comb'' Purgative Drench
''Red Comb'' Scaly Leg Ointment
''Red Comb'' Sulga
''Red Comb'' Vaginitis Powder
''Red Comb'' Veterinary Iodine
''Red Comb'' Vi-Tone
''Red Comb'' Worm Capsules
''Red Comb'' Worm Killer

Queensland Chemical & Distributing Co., 107 Eagle Street, Brisbane.

Vetrolene

Queensland Druggists Ltd., 518-520 Stanley Street, South Brisbane.

Penijec with Sigma Procaine Penicillin
Sigma Penijec 100 with Procaine Penicillin
Sigma Calcijec
Sigma Calcium Borogluconate
Sigma Calcium Boro-gluconate Solution
Sigma Fluro (Sodium Fluoride)

Queensland Pastoral Supplies Pty. Ltd., Bowen Street, Brisbane.

Hart's Immunol Carbon Tetrachloride Fluke and Worm Drench—Single Strength
Hart's Immunol Carbon Tetrachloride Fluke and Worm Drench—Double Strength
Hart's Immunol Concentrated Bluestone and Nicotine Sulphate Drench
Hart's Immunol Sulphur Antiseptic

Queensland Primary Producers Co-op. Assn. Ltd., Creek Street, Brisbane.

Blackleg Vaccine
Sickle Brand Liquaphene Liquid Phenothiazine

Riddell, R. A., Rome Street, Yeronga, Brisbane.

''Acaprin''
Ascaridol
Istin
Nemural
Omnadin

Robinson & Bott Pty. Ltd., 459 Adelaide Street, Brisbane.

Rawleigh's Antiseptic Salve
Rawleigh's Colic and Bloat Ease
Rawleigh's Veterinary Application

Salmond & Spraggon (Aust.) Pty. Ltd., 499 Adelaide Street, Brisbane.

Bob Martin's Fit and Hysteria Tablets
Bob Martin's Powders
Bob Martin's 92 Ointment for Dogs and Cats
Bob Martin's Tape Worm Powders
Bob Martin's Tape Worm Tablets
Elliman's Royal Embrocation for Horses and Cattle

Spedosol Supply Co., National Bank Building, Queen Street, Brisbane.

Spedosol Powder

Stuart's Serum Laboratory, Ferny Avenue, Surfers' Paradise.

Canine Anti-Tick Serum

Surgical Supplies Ltd., 428 Queen Street, Brisbane.

Bio Absorbine (Liquid)
Bio Antigen B.W.D.
Bio Antiseptic Dusting Powder
Bio Anti-Tetanic Serum
Bio Blackleg Aggressin (liquid)
Bio Blackleg Cords
Bio Blackleg Pellets
Bio Blackleg Solid Aggressin
Bio Blackleg Toxiculture
Bio Blue Lotion (Hopple Chafe)
Bio Blister Paste
Bio Bot Bombs
Bio Bowel Laxative for Dogs
Bio Bronchial and Pneumonic Mixture
Bio Calcigen
Bio Canker Powder
Bio Caponising Hormone for Fowls and Turkeys
Bio Chic-Pic
Bio Chorea and Epilepsy Mixture
Bio Cough Electuary
Bio Cough Mixture for Dogs
Bio Cunic Drench
Bio Diarrhoea Powder for Dogs
Bio Diuretic Ball
Bio Painidine
Bio Physic Ball
Bio Pleuro Virus
Bio Puppy Worm Syrup
Bio Purging Powder
Bio Q-Itch Dressing
Bio Red Blister
Bio Scabby Mouth Vaccine (Virus)
Bio Scours Remedy
Biosol
Bio Solid Absorbine
Bio Soothing Liniment
Bio Spasmodic Colic Drench
Bio Special Colic Drench
Bio Splintol
Bio Stock Drench (Liquid)
Bio Strangles Toxiculture
Bio Sulfa Quin Concentrate
Bio Sulfazene Concentrate
Bio Tapeworm Expeller for Dogs and Cats
Bio Tendonol

Bio Diuretic Powders
Bio Eczermol
Bio Emetic Capsules
Bio Emetic Pills
Bio Eye Lotion
Bio Eye Powder
Bio Flukure Carbon Drench for Sheep—Double Strength
Bio Foot Rot Dressing
Bio Fowl Pox Vaccine
Bio Gall Ointment
Bio Gastric Mixture
Bio Gamma Tik
Biogon
Biogon Tablets for Cows
Bio Greasy Heel Zinc Cream and Soothing Ointment
Bio Greyhound Liniment
Bio Greyhound Tonic
Bio Hoof Dressing
Bio Laxative Drench for Horses
Bio Likunic Worm Drench for Sheep
Bio Liniment
Bio Lung Worm Injection for Sheep
Bio Mastitis Toxiculture
Bio Pad Paint
Bio Titbalm
Bio Toxiculture for the Prevention and Treatment of Pneumonia in Pigs
Bio Toxiculture (B.T.5.) for the Prevention of Tetanus
Bio Ulcear
Bio Vaginol
Bio Worm Capsules
Bio Worm Capsules for Poultry
Bio Worm Powders for Horses
Bio Wound Balsam
Bio Wound Ointment
B.W.K. Bio Worm Killer for Fowls
B.W.K. Bio Worm Killer for Sheep (Old Formula)
B.W.K. Bio Worm Killer for Sheep (New Formula)
Sexine
Stewart's Bio Royal Embrocation
Stewart's Liquid Blister
Stewart's Wound Lotion

Taubmans (Qld.) Pty. Ltd., 95 Edward Street, Brisbane.

Taubmans Bluestone and Nicotine Sulphate Drench
Taubmans Carbon Tet. Fluke Drench—Double Strength

Taylors Elliotts Pty. Ltd., 150-160 Charlotte Street, Brisbane.

"Anavaxin" B.L. Vaccine for the Prevention of Black Leg in Sheep and Cattle
"Anavaxin" Alum Precipitated Concentrated B.D. Vaccine for Prevention of Infectious Necrotic Hepatitis of Sheep (Black Disease)
"Anavaxin" Alum Precipitated E.T. Vaccine for Prevention of Entero-Toxaemia of Sheep and Lambs
Austral Aloetic Physic Ball
Austral Barb Wire Embrocation
Austral Dairy Ointment
Austral Dehorning Cream
Austral Diuretic Drench for Cattle and Horses
Austral Dusting Powder
Austral Gall Ointment for Horses and Cattle
Austral Horse Blister
Austral Liquid Blister for Horses and Cattle
Austral Purgative Drench
Austral Scour Drench
Austral Trypan Blue
Austral Vaginal Douche Powders
Austral Veterinary Embrocation for Horses and Cattle
Benbow's Dog Mixture
"Cylol"
Doyle's Laryngine
Elliotts Coolabar
Elliotts Enca
Elliotts Elto
Elliotts Equaphen
Elliotts Europa
Elliotts Fenik
Elliotts Galar
Elliotts Hexapar
Elliotts Korotic
Elliotts Phenzeen
Elliotts Phenzeen Plus
Elliotts Quinto
Elliotts Sulfanox
Elliotts Tongar for Cattle
Elliotts Udder Ointment
Elliotts Worego
Elliotts Wotan for Sheep
Evans Blackleg F.W.C. Vaccine (Cattle)
Evans Blackleg F.W.C. Vaccine (Cattle)—(Pilules)
Evans Pirevan
Mastillin—G
Penetrene "A"
Reducine

Tudor & Petty, H. G., 64 Russell Street, Toowoomba.

T. & P. Vaginitis Powder

Uhl & Sons Pty. Ltd., L., 484-6 Queen Street, Brisbane.

"Aintree" Green Blister Ointment
"Aintree" Liniment
Black Physic Balls
Diuretic Balls for Horses and Mules
"Easakof"
Gall Ointment
"Kossolian" for Racehorses, Hunters, Polo Ponies, etc.
Red Paste Laxative Balls
Worm Powder for Horses
Wound Dressing

United Chemicals Pty. Ltd., 91-97 Montague Road, South Brisbane.

Germacol
United Medicated Stockholm Tar

Walsh & Ham, Mary Street, Gympie.

Cattle Blight Lotion

Watkins Co. Ltd., The J.R., 103 Mary Street, Brisbane.

Watkins Stock Drench
Watkins Veterinary Balm

Wilcox Mofflin Ltd., 68-70 Albert Street, Brisbane.

Cesto for Treatment of Tapeworm in Sheep
Fen-thy-zin
Nikosul
Red Spot (Double Strength) Fluke and Stomach Worm Drench
Tetralene Worm and Fluke Drench
Tri-Kos (Nicotine Sulphate and Copper Sulphate—Separate Ingredients)
Wilmo Blackleg Vaccine
Wilmo B.D.V. Black Disease Vaccine
Wilmo Calcium Borogluconate
Wilmo Scabby Mouth Vaccinating Unit
Wilmolene Tetrachlorethylene Drench

Index of Brands or Trade Names.

Brand or Trade Name.	Primary Dealer.
AHP	Pilcher, E.S.
AHP	Piddington & Co.
AHP Zealone	New Zealand Loan & Mercantile Agency Co. Ltd.
"Aintree"	L. Uhl & Sons Pty. Ltd.
"Amco"	Australian Mercantile Land & Finance Co. Ltd.
"Anavaxin"	Taylors Elliotts Pty. Ltd.
A.P.L.	Embelton & Co. Pty. Ltd., G.P.
Austral	Taylors Elliotts Pty. Ltd.
Barko	Mitchell Agencies Pty. Ltd., Kenneth
Baxter's	Maclean Pty. Ltd., D.
Bayer	Riddell, R. A.
Benbow's	Taylors Elliotts Pty. Ltd.
Bio	Surgical Supplies Pty. Ltd.
Bob Martin's	Salmond & Spraggon (Aust.) Pty. Ltd.
Buchanan's	Milking Machine Supplies Pty. Ltd.
Chemist Roush	Morden Laboratories
Cooper's	New Zealand Loan & Mercantile Agency Co. Ltd.
Doyle's	Taylors Elliotts Pty. Ltd.
Elliman's	Salmond & Spraggon (Aust.) Pty. Ltd.
Elliotts	Taylors Elliotts Pty. Ltd.
Ell-i-Vita	O'Meara, T. R.
Evans	Taylors Elliotts Pty. Ltd.
Farran	A.C.F. & Shirleys Fertilizers Ltd.
Fleego	David Pharmacies
Grazcos	Grazcos Co-op. Ltd.
Hagley's	Butler & Co. Pty. Ltd., Ed.
Hamilton	Baynes, J. H.
Happidog	Happidog Store Pty. Ltd.
Hart's	Queensland Pastoral Supplies Pty. Ltd.
Hayes'	Hayes Veterinary Co.
Judge's	Maclean Pty. Ltd., D.
K-Nine	David Pharmacies
Krect	Nyal Co. (Rep. A. Light)
Lane's	Madin & Pattison
Leghorn	Northern Veterinary Remedies
Mactaggarts'	Mactaggarts P.P. Co-op. Assn. Ltd.
"Max-Tar"	Mactaggarts P.P. Co-op. Assn. Ltd.
Meggitt's	Gollin & Co. Pty. Ltd.
Morden	Morden Laboratories
Nobles	Noble & Gegg, W. A.
Osmonds	Osmonds & Sons Pty. Ltd.
Pegasus	Bryce Ltd.
Phoenix	Faulding & Co. Ltd., F. H.
Pro-Vet	Baynes, J. H.
Quibell's	Dalgety & Co. Ltd.
Radiol	Bickford & Sons Ltd., A. M.
Rawleigh's	Robinson & Bott Pty. Ltd.
"Red Comb"	Poultry Farmers Co-op. Society Ltd.
Sickle Brand	Queensland Primary Producers Co-op. Assn. Ltd.
Sidolia	Norris Agencies Pty. Ltd.
Sigma	Queensland Druggists Ltd.
Spedosol	Spedosol Supply Co.
Stewart's	Surgical Supplies Ltd.
Sykes's	Nobles Pty. Ltd.
Taubmans	Taubmans (Qld.) Pty. Ltd.
T. & P.	Tudor & Petty, H. G.
United	United Chemicals Pty. Ltd.
"Vallo"	Leggo & Co. Pty. Ltd., A. Victor
Vetamac	McDonald & Co., A. H.
Victor Dryden's	Dryden, Victor
Vita-Lick	Goldsbrough Mort & Co. Ltd.
Wagstaff's	Blaiklock & Co. Pty. Ltd., H.
Watkins	Watkins Co. Ltd., The J.R.
"Wellcome"	Harveyson, T. C., Rep. Burroughs Wellcome
Wilmo	Wilcox Mofflin Ltd.
Wonderdog	Northern Veterinary Remedies

Brucellosis Testing of Swine.

The Department of Agriculture and Stock is operating a scheme whereby pig herds are tested at intervals for the occurrence of swine brucellosis (contagious abortion).

A herd listed by the Department as "brucellosis tested" is one in which all such animals as may be determined by the Director of the Department's Division of Animal Industry have been subjected to two successive tests for brucellosis, at intervals determined by him, without any positive reactors being found.

In order for a herd to be retained on the list of Tested Herds, a semi-annual or annual re-test of the herd, as determined by the Director, is required. If at a re-test any animal gives a positive reaction to the test the herd is removed from the list; it is not listed again until subsequent tests, as determined by the Director, have been carried out.

Full particulars of the Brucellosis Testing of Swine and application forms may be obtained from the Under Secretary, Department of Agriculture and Stock, William Street, Brisbane.

TESTED HERDS.
(AS AT 20th DECEMBER, 1951.)

Breed.	Owner's Name and Address of Stud.
Berkshire	S. S. Ashton, " Scotia " Stud, Pittsworth
	J. J. Bailey, " Lucydale " Stud, East Greenmount
	S. Cochrane, " Stanroy " Stud, Felton
	Garrawin Stud Farm Pty. Ltd., 657 Sandgate road, Clayfield
	G. Handley, " Handleigh " Stud, Murphy's Creek
	J. L. Handley, " Meadow Vale " Stud, Lockyer
	R. G. Koplick, " Melan Terez " Stud, Rochedale
	H. V. Littleton, " Wongalea " Stud, Crow's Nest
	O'Brien and Hickey, "Kildurham" Stud, Jandowae East
	E. Pukallus, " Plainby " Stud, Crow's Nest
	G. C. Traves, " Wynwood " Stud, Oakey
	E. Tumbridge, " Bidwell " Stud, Oakey
	Westbrook Farm Home for Boys, Westbrook
	H. W. Wyatte, Rocky Creek, Yarraman
	H. M. State Farm, " Palen Creek," Palen Creek
	A. R. Ludwig and Sons, " Cryna " Stud, Beaudesert
	H. H. Sellars, " Tabooba " Stud, Beaudesert
	F. Thomas, " Rosevale " Stud, Beaudesert
	Bowkett and Meacle, " Myola Vale " Stud Piggery, Burra Burri, Jandowae
	D. T. Law, Trouts Road, Aspley
	R. J. McCullough, " Maxholm " Berkshire Stud, Gatton
	C. F. W. and B. A. Schellback, " Redvilla " Stud, Kingaroy
	R. H. Crawley, " Rockthorpe " Stud, *via* Pittsworth
	F. R. J. Cook, " Alstonvilla," Wolvi, via Gympie
Large White	H. J. Franke and Sons, " Delvue " Stud, Cawdor
	Garrawin Stud Farm Pty. Ltd., 657 Sandgate road, Clayfield
	F. L. Hayward, " Curyo," Jandowae
	J. A. Heading, " Highfields," Murgon
	K. B. Jones, " Cefn " Stud, Pilton
	R. G. Koplick, " Melan Terez " Stud, Rochedale
	R. Postle, " Yaralla " Stud, Pittsworth
	E. C. Smith, " Smithfield " Stud, Coomera
	E. J. Bell, " Dorne " Stud, Chinchilla
	A. G, Fry, " Birubi " Stud, Dalby
	N. E. Myers, Halpine Plantation, Kallangur
	L. C. Lobegeiger, " Bremer Valley " Stud, Moorang, *via* Rosewood

TESTED HERDS—continued.

Breed.	Owner's Name and Address of Stud.
Large White—*continued*	J. H. G. Blakeney, " Talgai " Stud, Clifton
	V. P. McGoldrick, " Fairymeadow " Stud, Cooroy
	N. Woltmann and Sons, Wooroolin
	R. S. Powell, Kybong, via Gympie
	E. B. Horne, " Kalringal," Wooroolin
Tamworth	S. Kanowski, "Miecho " Stud, Pinelands
	N. R. Potter, " Actonvale " Stud, Wellcamp
	D. F. L. Skerman, " Waverley " Stud, Kaimkillenbun
	A. C. Fletcher, " Myola " Stud, Jimbour
	L. C. Lobegeiger, " Bremer Valley " Stud, Moorang, *via* Rosewood
	Salvation Army Home for Boys, Riverview
	F. Thomas, " Rosevale " Stud, Beaudesert
	A. J. Surman, Noble Road, Goodna
	P. V. McKewin, " Wattleglen " Stud, Goombungee
	Department of Agriculture and Stock, Regional Experiment Station, Kairi
	P. V. Campbell, Lawn Hill, Lamington
Wessex Saddleback . .	W. S. Douglas, " Greylight " Stud, Goombungee
	K. Day and P. Hunting, " Kazan " Stud, Goodna
	E. Sirrett, " Iona Vale " Stud, Kuraby
	C. R. Smith, " Belton Park " Stud, Nara
	H. H. Sellars, " Tabooba " Stud, Beaudesert
	H. Thomas, " Eurara " Stud, Beaudesert
	D. T. Law, Trouts Road, Aspley
	G. J. Wilson, " Glenbella " Stud, Silverleigh
	G. J. Cooper, " Cedar Glen," Yarraman
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ASTRONOMICAL DATA FOR QUEENSLAND.

FEBRUARY.

Supplied by W. J. Newell, Hon. Secretary of the Astronomical Society of Queensland.

TIMES OF SUNRISE AND SUNSET.

At Brisbane.			MINUTES LATER THAN BRISBANE AT OTHER PLACES.					
Day.	Rise.	Set.	Place.	Rise.	Set.	Place.	Rise.	Set.
	a.m.	p.m.						
1	5.21	6.42	Cairns	41	17	Longreach	40	30
6	5.24	6.40	Charleville ..	29	25	Quilpie	34	36
11	5.28	6.36	Cloncurry	57	42	Rockhampton .	15	5
16	5.32	6.32	Cunnamulla ..	28	30	Roma	18	16
21	5.35	6.28	Dirranbandi ..	18	20	Townsville ..	34	16
26	5.38	6.23	Emerald	24	14	Winton	46	34
29	5.40	6.21	Hughenden ..	42	27	Warwick	3	5

TIMES OF MOONRISE AND MOONSET.

At Brisbane.

Day.	Rise.	Set.
	a.m.	p.m.
1	10.37	10.04
2	11.37	10.39
	p.m.	
3	12.37	11.17
4	1.36	12.00
5	2.33	..
		a.m.
6	3.27	12.46
7	4.16	1.37
8	5.00	2.32
9	5.40	3.27
10	6.15	4.28
11	6.46	5.19
12	7.16	6.13
13	7.44	7.07
14	8.13	8.00
15	8.42	8.55
16	9.15	9.52
17	9.51	10.51
18	10.34	11.54
		p.m.
19	11.24	12.59
20	..	2.05
	a.m.	
21	12.24	3.07
22	1.31	4.05
23	2.41	4.55
24	3.53	5.38
25	5.04	6.17
26	6.11	6.52
27	7.16	7.26
28	8.19	8.00
29	9.22	8.35

MINUTES LATER THAN BRISBANE (SOUTHERN DISTRICTS).

Charleville 27 ; Cunnamulla 29 ; Dirranbandi 19 ; Quilpie 35 ; Roma 17 ; Warwick 4.

MINUTES LATER THAN BRISBANE (CENTRAL DISTRICTS).

Day.	Emerald.		Longreach.		Rockhampton.		Winton.	
	Rise	Set.	Rise.	Set.	Rise.	Set.	Rise.	Set.
1	15	22	30	38	6	13	35	44
6	9	30	25	45	0	21	26	54
11	14	25	30	41	5	16	34	48
16	25	14	41	30	16	5	47	33
21	30	9	46	23	21	0	54	26
26	21	19	38	34	12	10	43	38
29	14	25	29	41	4	17	33	49

MINUTES LATER THAN BRISBANE (NORTHERN DISTRICTS).

Day.	Cairns.		Cloncurry.		Hughenden.		Townsville.	
	Rise.	Set.	Rise.	Set.	Rise.	Set.	Rise.	Set.
1	20	36	43	55	28	40	17	31
3	9	46	37	61	21	47	8	38
5	3	56	34	67	18	53	4	46
7	3	56	34	67	18	53	4	46
9	9	51	37	64	21	50	8	43
11	18	43	42	59	27	45	16	36
13	27	33	49	54	33	38	23	29
15	38	23	56	45	41	30	32	20
17	47	12	63	38	47	24	39	12
19	55	4	68	33	51	19	45	5
21	56	2	68	32	52	17	46	3
23	52	9	66	36	50	22	43	9
25	41	21	57	44	42	29	34	18
27	28	33	50	54	34	38	24	29
29	17	44	41	60	26	46	15	37

Phases of the Moon.—First Quarter, February 3rd, 6.01 a.m.; Full Moon, February 11th, 10.28 a.m.; Last Quarter, February 19th, 4.01 a.m.; New Moon, February 25th, 7.1 p.m.

On February 15th the Sun will rise and set 15 degrees south of true east and true west respectively and on the 13th and 27th the Moon will rise and set approximately at true east and true west.

On February 11th there will be a partial eclipse of the Moon visible from Asia, Europe, Africa, North America and South America, and on February 25th there will be a total eclipse of the Sun visible from Asia, Europe and Africa.

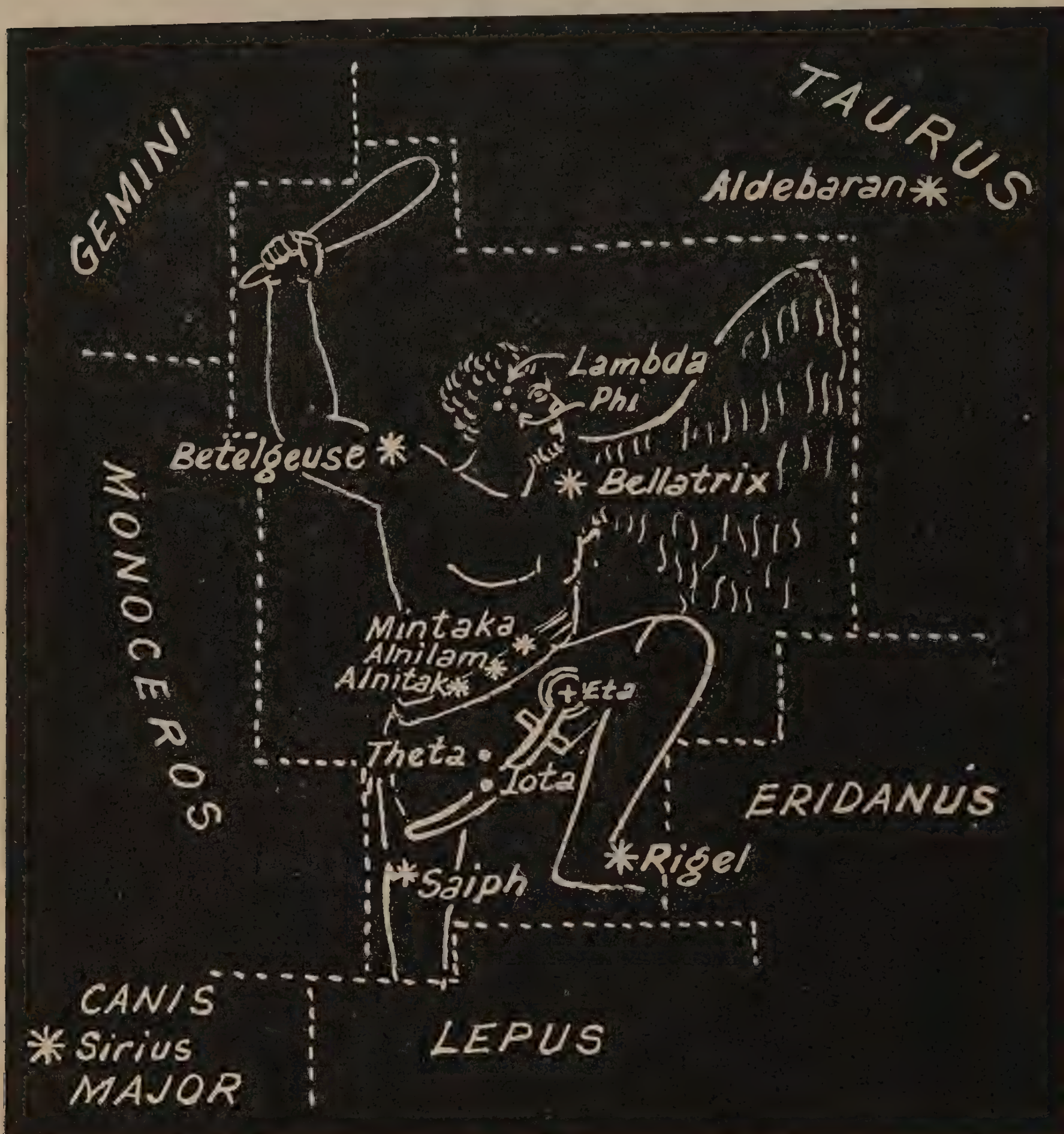
Mercury.—A morning object at the beginning of the month when in the constellation of Sagittarius it will rise a little over 1 hour before the Sun. On the 22nd it will be in line with the Sun after which it will become an evening object. At the end of the month, in the constellation of Aquarius, it will set about 20 minutes after sunset.

Venus.—Still a brilliant morning object. Situated in the constellation of Sagittarius at the beginning of the month it will rise about 2¾ hours before the Sun. At the end of the month, in the constellation of Capricornus it will rise about 2 hours before sunrise.

Mars.—In the constellation of Virgo at the beginning of February it will rise between 10.45 p.m. and 11.15 p.m. On the 18th the Moon will be situated near Mars and the planet will rise between 9.30 p.m. and 10.45 p.m. at the close of February.

Jupiter.—Now setting during early evening. On the 1st it will set between 9.45 and 11 p.m. and on the 29th between 8 p.m. and 9.15 p.m. On the 28th the Moon will be situated near Jupiter.

Saturn.—In the constellation of Virgo will rise between 10 p.m. and 11.15 p.m. at the beginning of the month and between 8 p.m. and 9.15 p.m. at the end of the month. On the 16th the Moon will pass close to this planet.



THE CONSTELLATIONS.

ORION.

Orion, the Hunter, is one of the most impressive constellations in the sky; old star maps show it as a male figure with Betelgeuse (Alpha) on the right shoulder, Bellatrix (Gamma) on the left shoulder, Rigel (Beta) on his left foot and Saiph (Kappa) on his right thigh. The three stars in line (Delta, Epsilon and Zeta) known as Mintaka, Alnilam and Alnitak respectively, are shown as the sword belt; with a line of three fainter stars which include Theta and Iota representing the sword hanging from the belt. Betelgeuse, which is an irregular variable star, ruddy in hue, was the first star to have its diameter measured directly with the interferometer on the 100 inch Hooker telescope at Mount Wilson. Its diameter was found to vary, the pulsations, no doubt, being the cause of its light variation. Its mean diameter is 300 million miles—greater than the orbit of Mars—and it is one of the largest stars known. Rigel has a companion of 6.7 magnitude which is rather hard to see with small telescopes on account of the brilliance of Rigel itself. Mintaka, at the western end of the belt is practically n the celestial equator, having an angle of 0° 20' south. It is a double star of 2nd and 7th magnitudes about 53 seconds apart while Zeta at the other end of the belt is also a double, only 2.8 seconds apart and 2nd and 5th magnitudes. Just south of Zeta is Sigma, a fine group of four stars with striking colours. Running due south from and making an angle of about 45° with the belt is a line of faint stars—The Sword. The furthest from the belt is Iota, a double of 3.2 and 7.3 magnitudes separated by 11.4 secnds. The hazy one in the centre is Theta which is surrounded by the "Great Orion Nebula." Telescopic examination will resolve Theta into four faint stars known as the "Trapezium in Orion." On a moonless night this is a beautiful object. At the apex of a small triangle with Betelgeuse and Bellatrix as base will be seen a misty spot which optical aid will expand into a nice little group. About a third of the way from Delta to Beta is Eta, a double of 3.8 and 4.8 magnitudes separated by 1.4 seconds. The whole of Orion seems more or less bathed in nebulosity, most of which, however, only shows on long exposure photographs. Near Zeta is the famous "Horse Head," a dark nebula which shows up against the background of luminous nebulosity as a definite horse's head. Orion is on the meridian at 8 p.m. about the middle of February.

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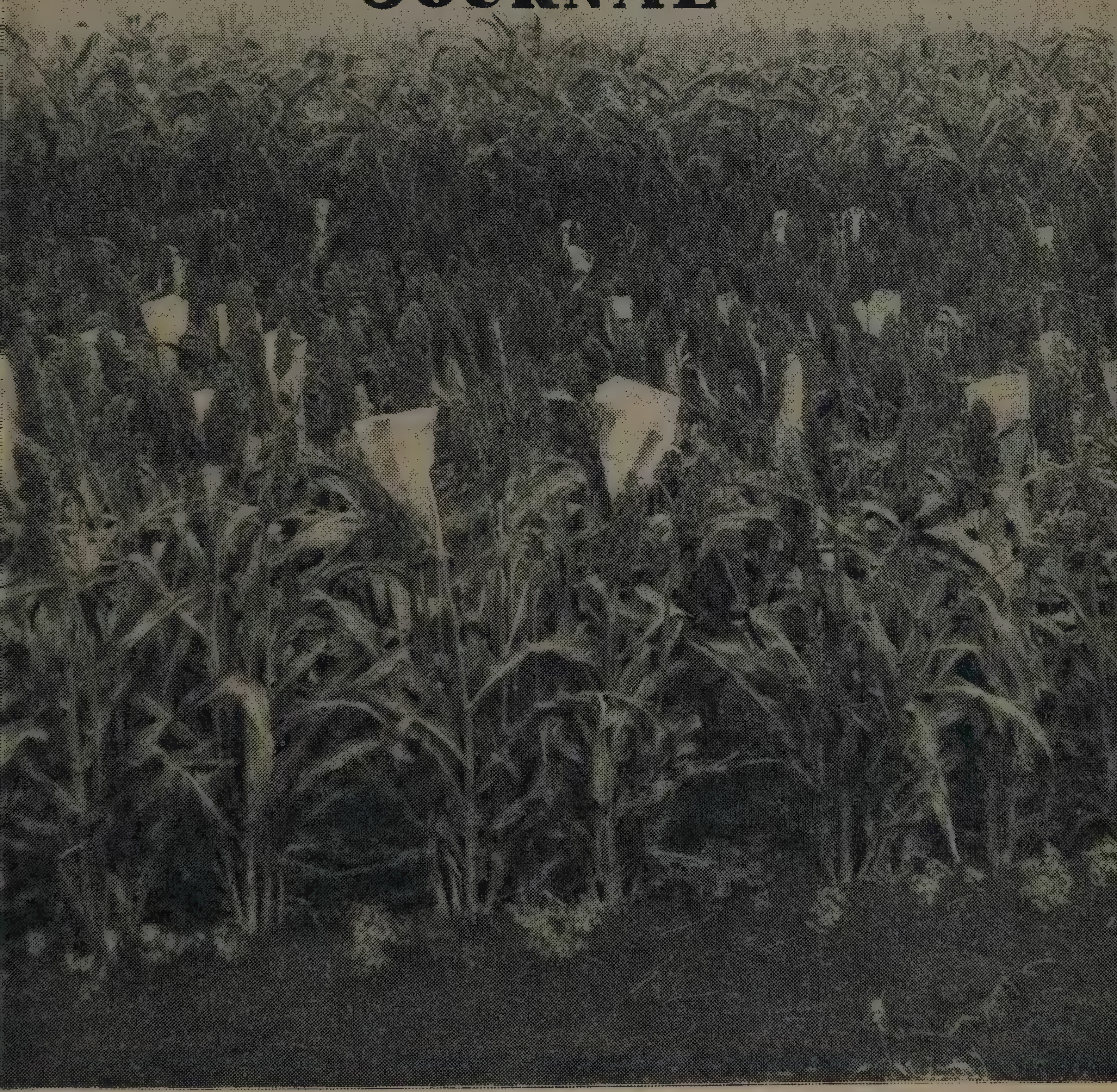

Sorghum Breeding Plot, Kingaroy.

LEADING FEATURES

The Apple

Pumpkins

Botulism in Poultry

Dairy Herd Wastage Survey

The Overfat Pig.

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Volume 74 Part 2

QUEENSLAND AGRICULTURAL JOURNAL

Edited by
C. W. WINDERS, B.Sc.Agr.

AUDAX AT FIDELIS

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ROMA STREET . . . . BRISBANE

The Apple.

K. M. WARD, Senior Horticulturist, Horticulture Branch.

(*Continued from page* 21 *of the January issue.*)

THE EFFECTS OF CLIMATE.

THE apple cannot be grown commercially in the tropics except perhaps at very high altitudes because the buds must be subjected to winter temperatures averaging 48 deg. F. or less for two or three months. In the absence of such temperatures, many buds fail to open and shoot growth is weak, crops are small and ripening takes place over an abnormally long period. In some other deciduous fruits, mild winter temperatures cause bud shedding, but in the apple the buds may either remain dormant or open with a reduced number of flowers or none at all. Under these conditions the trees do not become fully dormant, shoot growth may be present throughout the year, and limited flowering can occur at almost any time.

When growth begins in spring, the apple tree loses its resistance to low temperatures, and frosts can then cause severe crop loss by the freezing of the flower buds or young fruits. Sometimes a few warm days cause swelling buds to become very tender and a subsequent cold snap will kill vital tissues in the bud and induce shedding of many flower clusters before they open. This may occur at temperatures of 26 deg. F. to 28 deg. F., which also kill fully opened blossoms. Fruit which has just set may be destroyed at slightly higher temperatures and it is soon shed. Sometimes the pistil is killed while the other parts of the flower are undamaged; flowers affected in this way may open normally, but cannot produce fruit. If the frost is not sufficiently severe to kill young fruit, it may cause russetting and malformations of various types.

A sudden fall in temperature may cause bark splitting on either the trunk or branches, and if this occurs late in the winter, sap oozes out from the split section. The sap is usually sweet to the taste because of the high concentration of sugar and other soluble materials in it. The condition is more common in Gravenstein than in other varieties grown in the Stanthorpe area. A somewhat similar trouble in young trees, known as sour sap, is attributed, partly at least, to low temperatures following premature commencement of growth in early spring; but it may also be associated with the presence of stagnant water in the root zone of the trees.

The water requirements of an apple orchard may be satisfied by a minimum rainfall of about 20 inches when it is well distributed through the year. At Stanthorpe, sunshine is usually intense and prolonged and evaporation relatively high. Under these conditions the average yearly rainfall of 30 inches is adequate for growth and fruit production in most years and irrigation is therefore not essential.

High winds may reduce fruit setting, and also cause severe losses in a maturing crop from fruit drop and skin blemishes. They may also delay the application of sprays at a critical time. The orchard should therefore be so situated that it is protected by hills or belts of timber which lift prevailing winds over the trees. In the absence of natural protection, wind damage can be reduced by planting rows of tall trees along the boundary of the orchard. These must not, however, impede air drainage on frosty nights, for on such nights cold air flows to lower levels and is replaced by warmer air from higher ground.

SELECTION OF ORCHARD SITE.

An orchard represents a long term investment, and apart from basic factors such as suitability of soil and climate, consideration must be given to the effects of erosion, topography, aspect and accessibility, when selecting an area of land for apple trees.

Plate 48.

Vigorous Young Apple Trees Growing in Deep Granitic Soil.

Soil erosion is frequently responsible for the early decline of an orchard, and if the slope of the land or the nature of the soil is such that it cannot be protected against this danger, fruit trees should not be planted.

The topography of the land should ensure protection from injurious winds and the most favourable aspects for sunlight and warmth face toward the east or north-east. High land rising from a

valley or depression, or situated on a broad ridge, is preferable to low-lying ground. The gradient of the slope determines the ease or otherwise of orchard operations such as cultivation and harvesting and it is generally impracticable to cultivate land having a slope of 15 per cent. (1 in 6.7) or more.

A good water supply is essential for spraying.

Ease of access to the property is necessary if transport costs are to be kept within reasonable limits.

PROPAGATION.

The apple, like other deciduous fruits, is not reproduced true to type from seed, and trees are therefore propagated by vegetative methods, scions of the desired variety usually being worked on to a suitable stock by budding or grafting. Apple trees are accordingly grown on Northern Spy, seedling, Merton and other selected stocks. Trees may also be propagated on their own roots by layering in the nursery.

Northern Spy came into common use as a stock because of its resistance to woolly aphis attacks, and the majority of trees at Stanthorpe are worked on to this rootstock. Under favourable conditions, Spy stocks support fairly large trees which crop consistently, but where the rainfall is not reliable and the soil is relatively infertile, the trees tend to be stunted and short-lived. The root system normally is fairly extensive but rather shallow, especially when worked to the Granny Smith variety.

Apple varieties are often worked on seedling stocks derived from the cider apple known as French Crab, and on other selected seedlings. Though trees on seedling roots may vary considerably in vigour, they are generally more vigorous and larger than those on Spy roots. Seedling rootstocks are usually susceptible to woolly aphis but their vigour and recent improvements in control measures for this insect largely offset this disadvantage.

Neither of the above rootstocks is wholly satisfactory for the Stanthorpe district and they may be replaced in new commercial plantings by other types. The following are some of the more important.

(*i.*) *Merton* stocks, bred at the John Innes Horticultural Institute by crossing Malling II. with Northern Spy, are resistant to attack by woolly aphis. At Stanthorpe, two of them—No. 793 and No. 778—produce strong root systems which penetrate deeply into the soil and scion varieties worked on to them are both vigorous and fruitful. Plantings of trees on these stocks are likely to increase considerably in the near future.

(*ii.*) *Malling XII.* and *XVI.* are the most vigorous of the Malling stocks studied at Stanthorpe. Both are strongly rooted, and though trees on them are rather slow to reach the full bearing stage, they are at 14 years of age yielding particularly good crops.

(*iii.*) *S4,* a local selection, shows considerable promise as a rootstock. Trees on this stock are more vigorous and have a more upright habit of growth than those on Spy. S4 roots readily, possesses abundant fibrous roots, transplants easily and is fairly resistant to woolly aphis.

The production of own-rooted trees by either layering or root grafting has not been used to any extent at Stanthorpe but this method of propagation should prove useful for some varieties. These trees have no graft or bud union and therefore no structural weakness, and any risk of incompatability between stock and scion is eliminated. However, some varieties, such as Granny Smith, produce stunted trees on their own roots under Stanthorpe conditions and are not suitable for propagation in this way.

POLLINATION.

Quite apart from the climatic, nutritional and other factors which influence the setting of an apple crop, pollination has an important bearing on the fruitfulness of an orchard. For the development of the apple to maturity, pollination of the flower, followed by fertilisation of the ovule, is essential. Pollen can come from flowers of the same variety, in which case the variety is self-pollinated; or from the flower of a different variety, when cross-pollination takes place. Fertilisation of the ovule after pollination cannot occur if the variety is self unfruitful, and most apple varieties must therefore be interplanted with other varieties if they are to crop normally. In providing for cross-pollination, the main precaution is to interplant varieties which come into bearing at the same age and blossom at about the same time.

Though cross-pollination is desirable for maximum production and to compensate for adverse conditions during the setting period, excessive cross-pollination may sometimes cause abnormally heavy setting and induce a biennial bearing habit in the trees. Cross-pollination can, however, be regulated by spacing the pollinating trees in the orchard.

Suitable and Unsuitable Combinations.

Under Stanthorpe conditions cross-pollination is essential for consistent cropping and maximum yields. The time of flowering may vary from season to season but the order in which the several varieties flower is generally the same within any one district. The period over which the blossoms open may be relatively short or long according to prevailing temperatures. High temperatures shorten the flowering period, and there is then considerable overlapping of flowering in all varieties except the very early and the very late. If spring temperatures are low, the flowering periods of early and late varieties are more widely separated and they may not then be effective pollenisers for mid-season varieties.

Fortunately, the three main varieties grown in the Stanthorpe area are cross-fruitful and can usually be interplanted for pollination purposes. Granny Smith and Jonathan are suitable pollenisers for each other. Delicious is usually interplanted with Jonathan because overlapping of the flowering periods of these two varities is common. Some varieties such as Gravenstein, Winesap and Stayman Winesap are useless for cross-pollination because their pollen is infertile. These varieties are also self-unfruitful and benefit from pollination with other varieties such as Delicious. McIntosh, another self-unfruitful variety, must be interplanted with an early blossoming variety such as Jonathan.

Provision can be made for cross-pollination by interplanting with cross-fruitful varieties, and by grafting scions of a pollenising variety on to a few trees in block plantings of a single variety.

PRUNING AND RE-WORKING.

Pruning and re-working can best be learned from demonstration and the study of the growing and fruiting habits of apple trees. Hard and fast rules cannot be prescribed because each variety and each tree must be treated individually according to its age and vigour. The following notes are generally applicable to the Stanthorpe district.

Early training of the apple tree aims at the formation of a sturdy framework capable of carrying heavy crops. After fruiting has commenced, the tree is pruned each winter:—(*a*) to assist in the regular production of fruit of good size and quality; (*b*) to regulate tree size so that spraying and other operations can be performed conveniently; and (*c*) to remove superfluous growth and senile or weak wood. Skill is needed to maintain a balance between excessive fruiting wood, which causes overproduction and weakens the tree, and excessive vegetative growth, which can be induced by over-pruning in the early life of the tree and results in light cropping.

Pruning the Young Tree.

Vigorous vegetative growth in the young tree is needed to build a strong, stable framework, and this is obtained by relatively hard cutting back in the early years. A short stem of 18-20 inches is desirable and the main framework branches should arise from this stem at different heights to form a strong crotch.

After the third year the amount of pruning is gradually reduced until about the sixth year. If only the bud nearest the cut on a pruned shoot grows, other buds immediately below it can usually be induced to break by pinching back the terminal shoot when it is a few inches long. Unwanted shoots on pruned leaders should be suppressed; only the top two or three buds on each main branch are allowed to grow.

During the later stage of the formative period of the tree's life, numerous lateral twigs will have been produced. Some of these can be developed into fruiting arms on the leaders, others are simply cut back to form spurs, particularly in the lower portions of the tree, and a number are suppressed completely to prevent overcrowding. A few laterals on the outside of the branches may be left intact so long as they are not longer than about 15 inches: they will fruit at an early stage and may subsequently be removed or shortened to develop spurs. A well-formed tree should have at least 12 main branches, some of which grow towards the centre of the tree to provide protection from the summer sun (Plate 49).

Pruning Bearing Trees.

The production of fruit markedly reduces the amount of vegetative growth on the tree and pruning then becomes much less severe than it was during the training period. Severe pruning of the bearing tree has a stunting effect on the tree and reduces yields. In some overseas countries pruning of mature apple trees is restricted to the removal of weak branches and the occasional shortening back of others. Under such treatment the trees grow to a considerable size, large crops

Plate 49.

Young Granny Smith Apple Tree at the Early Fruiting Stage.
Note the strong crotch with branches arising at different levels and an adequate number of leader and sub-leader branches.

of rather inferior fruit are borne towards the extremities of the branches, and orchard management is difficult. Under Queensland conditions, moderate pruning is required to control the yield and quality of the fruit as well as tree growth. Hard cutting of the bearing tree does not produce more vigorous growth but will ultimately cause stunting and "stagginess."

Treatment of Annual Wood.

Leader growth should be continuous, and regular cutting back is usually necessary to produce sturdy main branches with a slightly spreading habit. On very vigorous trees, however, leader growth can sometimes be left uncut for one or two seasons to induce spur formation and reduce terminal growth. When this growth has steadied down, pruning may consist of cutting back the leaders by approximately two-thirds of their annual growth, more or less, according to the condition of the tree.

Lateral shoots are of two kinds—those which carry leaf buds only and those with leaf buds on the stem but terminating in a fruit bud. Fruiting on the latter type of shoot should be encouraged. Laterals up to 15 inches in length can often be left unpruned until they have formed spurs or have borne fruit, but longer laterals should be shortened. This

Plate 50.
Old Apple Spurs. Branched spurs 13 years old (left) and 10 years old (right). Note weakening of growth towards the tips of the spur growth.

will result in the growth of shoots from one or two terminal buds, and of spurs from buds nearer the basal portion of the shoot. The unpruned laterals bearing leaf buds only will develop spurs in the second year and can then be cut back to a suitable spur or bud or shortened after they have fruited. As the Jonathan is largely a lateral bearer, lateral shoots up to 18 inches in length are oftened tipped to assist the formation of strong buds for the next year's crop. This variety commonly carries several "blind" buds at the base of lateral shoots and short pruning of these shoots is therefore to be avoided.

Laterals which bear a flower bud at the tip will carry terminal fruit in the following year. These shoots require ample room on the tree. As the fruit grows, the leaf buds lower down develop into spurs and, in subsequent pruning, the lateral is either shortened or cut back to a spur. By the careful pruning of laterals, it is possible to develop fruiting arms with twigs and spurs and also secondary branches at almost any desired level. Some laterals must be removed entirely to prevent overcrowding.

Spur Growth.

In the past, trees were trained so that the fruit was borne mainly on spurs, but pruning to induce fruiting on lateral growth is now considered desirable. The pruning of spurs is often delayed until the tree has been fruiting for some years and the old spurs are weak (Plate 50). At this stage, the tree is usually overcrowded with spur growth and it is necessary to thin out the surplus spurs and shorten the rest back to ensure renewed growth and to regulate cropping. Spur pruning is tedious and time consuming and should, therefore, be kept to a minimum by developing, as far as practicable, the system of fruiting largely on laterals.

Summer Pruning.

The practice of pinching out the growing tips of vigorous leaders and other shoots in the summer is occasionally adopted to encourage the development of backward shoots or to induce growth from a nearby latent bud. The operation may have to be repeated more than once to produce the required effect.

Treatment of Old Trees.

Trees in which shoot growth is weak or the branches and spurs are overcrowded can often be brought to a more vigorous and fruitful condition by pruning methods used in conjunction with sound cultural practices. In this case, pruning consists of thinning out the branches, particularly the weaker ones, and simultaneously reducing the number of old spurs by removing some and shortening back the remainder. Opening up the centre of the tree may also assist in the production of new growth.

RE-WORKING OR CHANGING THE VARIETY.

Trees bearing non-commercial apples can be re-worked to profitable varieties provided they are in a sound, healthy condition. By this means, a planting of unsuitable varieties can be changed to a more payable one in two to four years. There are several methods of re-working trees.

Top Working.

Top working or stump grafting involves the removal of most of the top of the tree by cutting back the branches to a point about 12 inches above the crotch, and then grafting scions of the required variety onto the stubs of the branches (Plate 51). The strap graft is probably the most suitable for this purpose, but the bark graft may also be used.

Plate 51.
Stump Grafting of Apple Tree. Strap grafts after one growing season.

Top working is best suited to trees which are not more than 10 years of age. Older trees seldom attain their former size or cropping capacity after treatment, and are very subject to wound infection by fungi. Wounds should be sealed with a grafting wax, bituminous compound or clay to prevent drying out of the graft and the entry of water.

Advantages of top working are its simplicity, speed and cheapness.

Re-furnishing.

Re-furnishing is practised on full grown or old apple trees which need re-working. The main branches are skeletonised or "poled" by the removal of small laterals, spurs and secondary branches. On those parts of the tree most likely to be affected by sunburn, a number of laterals are retained for a season to provide protecting foliage. Some growth is also retained temporarily on the upper portion of each branch to assist the flow of sap.

Several types of grafts are used to re-furnish the branches prepared in the above manner. The best of these are the "L," the inverted T, and the gouge bark grafts, all of which are suitable for the apple.

Plate 52.

A Combination of Stump Grafting and Re-furnishing with Stub Grafts.

A stub graft is often used in conjunction with the bark graft (Plate 52). It involves the grafting of scions on to 2-inch stubs of selected laterals which have been cut back; the whip-tongue, side-cleft, and various bark grafts are used.

Re-furnishing quickly brings a tree into production again and this may more than offset the heavy initial labour cost.

SOIL MANAGEMENT.

Efficient soil management is the key to successful crop production, for upon it depends the ultimate fruitfulness of the trees. Physical and chemical conditions in the soil profoundly influence the health of the tree and the period of commercial fruit production. It is therefore necessary to apply practices which (*a*) keep a good supply of organic matter in the soil; (*b*) prevent loss by soil erosion; (*c*) control soil moisture; and (*d*) make good any deficiencies in nutrient materials.

ORGANIC MATTER AND GREEN MANURING.

Decomposed organic matter improves the fertility of the soil by increasing its permeability to water and air, by stimulating the activity of micro-organisms which help to make nutrient materials available to plants, by directly providing nitrogen and other essential elements, and by improving moisture holding capacity.

Soil quickly loses organic matter when it is cultivated and this loss is very rapid in sandy soils such as those at Stanthorpe. The most practicable, and probably the most effective, means of replacing or building up organic matter is green manuring. Under Stanthorpe conditions, suitable green manure crops are best grown during autumn and winter to be turned in during early spring.

Suitable Varieties.

New Zealand blue lupin, golden tares, black winter rye and some varieties of oats are all well suited to the Stanthorpe district. They are winter growing plants capable of resisting severe frosts and dry soil conditions. The main growing periods of each, from germination to early flowering, are as follows:—New Zealand blue lupin, 20 weeks; golden tares, 24 weeks; black winter rye, 18 weeks; oats, 17 weeks.

Plate 53.
A Good Stand of New Zealand Blue Lupin Grown in a Stanthorpe Orchard as a Winter Green Manure Crop.

Summer cover crops are seldom grown because they hinder spraying, harvesting and other orchard operations. The most popular winter green manure is New Zealand blue lupin (Plate 53), which can almost invariably be established by sowing in two or more successive years, following the inoculation of the seed in the first year with root nodule bacteria, and a light application of fertilizer. It is sound practice to grow this legume for two or three years and then change to a cereal crop for one year.

Sowing the Seed.

The seed should be sown as early as practicable in the autumn, or even in late summer, preferably during February or March. The crop will then make the greater part of its growth before winter and can be ploughed in or otherwise disposed of in early spring. Early planting is desirable, too, so that the crop will benefit from the rains which usually fall in February and March.

The seed is broadcast at the following rates per acre:—New Zealand blue lupin, 1 bushel (60 lb.); golden tares, ¾ bushel (45 lb.); black winter rye, 1 bushel (60 lb.); oats, 1 bushel (40 lb.). The rate of seeding for blue lupin may be reduced to ¾ bushel per acre when satisfactory crops have been grown previously on the land. The seed may be covered by means of a disc harrow, a rotary hoe, or, less effectively, tined implements.

Legume Seed Inoculation.

Growth of leguminous cover crops is usually improved by the establishment of nitrogen-fixing bacteria in the orchard soil. These bacteria live on the roots of the plant, where they form nodules in which fixation of atmospheric nitrogen takes place. Suitable strains of these organisms may be established by inoculating the seed immediately prior to sowing. The seed is wetted with skim milk containing the bacteria in suspension, and after drying in shade it is ready for sowing. Inoculated seed should be covered as soon as possible after broadcasting, as sunlight will destroy the bacteria adhering to the seed coat. Dry soil is also detrimental to the bacteria. When the correct strain of bacteria has once been successfully established in the soil, as shown by the presence of nodules on the legume roots, it should remain effective for that crop for a long time.

Fertilizing the Green Manure Crop.

Correct fertilizing greatly benefits the green manure crop, more especially in soils which have not previously grown satisfactory crops. The fertilizer used becomes available to the fruit trees later on when the green manure decomposes in the soil. As the fertility of the soil is built up by regular green manuring, a stage is usually reached when fertilizing of the crop is unnecessary.

Fertilizers for leguminous crops should contain approximately 4 per cent. nitrogen, 15 per cent. phosphoric acid and 2 per cent. potash. Mixtures made up of equal quantities of sulphate of ammonia and superphosphate also give good results. The quantity needed depends on the fertility of the soil and ranges from 2 to 3 cwt. per acre. Cereal crops respond only to nitrogenous fertilizers, a suitable rate of application being 1 to 2 cwt. per acre of sulphate of ammonia or a slightly greater amount of nitrate of soda. The fertilizer may be

broadcast when the soil is given its final preparation for sowing, or immediately before sowing the seed. Fertilizer as well as seed may be worked into the soil by discing or harrowing.

Disposal of the Crop.

Leguminous cover crops should be turned in when they show the first signs of flowering. At this stage the amount of green matter is at its maximum and the plants still contain a relatively high proportion of nitrogen. It is important, therefore, to time the sowing of the seed so that the crop can be turned in between late August and early September, before excessive competition for moisture between the green crop and the fruit trees takes place in the spring, which is usually dry at Stanthorpe. Blue lupin should be sown not later than the end of March, but golden tares, which grow more slowly, must be planted at least a month earlier.

Cereal crops should be turned in earlier than leguminous crops because they decompose more slowly and in the course of decomposition they may deprive the trees of nitrogen in the spring when nitrogen demands by the trees are high. The risk of such competition may be reduced by applying a nitrogenous fertilizer at the time the green manure crop is turned in. In general, legumes should be turned in at least three weeks and cereals about five weeks before the end of the dormant period of the trees.

Stubble mulching may be practised as an alternative to turning the crop into the ground.

SOIL AND MOISTURE CONSERVATION.

Loss of soil by erosion, especially sheet erosion, is usually more prevalent than is generally realised. The greatest loss in Stanthorpe orchards is caused by water erosion in heavy storms and can be prevented by a system of management which combines any of these measures:—

(1) Planting on the contour with any necessary provision for grade-line drains (that is, graded "contour" drains). Drains with a fall of 2-4 feet per 100 feet check the downhill rush of water and divert it, under control, to grassed waterways. In orchards planted on the contour, cultivation is always across the slope, never up and down, and the amount of run-off water is reduced to a minimum.

(2) In orchards planted on the square system, grade-line drains can be constructed to control water flow.

(3) The soil surface should be protected during the wet season by a cover of weeds which can be mown during dry weather to eliminate competition for moisture between trees and weeds.

In a non-irrigated area such as Stanthorpe with a moderate rainfall, the conservation of soil moisture is often important. Apart from contour planting, which increases the amount of water absorbed into the soil, soil moisture can be controlled to some extent by checking weeds, by building up organic matter in the soil, by rough or trashy cultivation to reduce run-off and by surface mulching. When weeds are profuse they may be mown and the mulch so formed on the surface, together with the roots left in the soil, assists in holding the soil in any subsequent rain-storms. Clean cultivation does not conserve moisture, except insofar as it eliminates weed growth.

NUTRITION OF APPLE TREES.

Soil management and tree nutrition are intimately linked together. The application of artificial fertilizers alone to Stanthorpe soils is unlikely to produce the desired response in tree growth and yield; soil conditions must be good to ensure the uptake of nutrients (Plate 54). Furthermore, tree nutrition will be incomplete or unsatisfactory if important trace elements are in short supply, and if the several nutrients are unbalanced. The soils of the area are generally low in nitrogen, calcium and phosphate, but potash is fairly plentiful. Trace elements required by the trees are copper, zinc and boron.

Plate 54.
An Apple Tree Suffering from Malnutrition.

Major Elements.

Nitrogen.

Nitrogen is necessary for tree growth and is frequently deficient in the soil. Early symptoms of a deficiency are yellowish-green leaves and reduced shoot growth with small pale leaves. Later the shoots become short and spindly, the bark acquires a reddish tint, blossoming

is usually poor and the fruit is small, though bright in colour and possessing good storage qualities. The affected trees usually shed their foliage abnormally early.

If the soil contains little or no organic matter, the liberal use of nitrogenous fertilizers may not prove an effective means of supplying trees with nitrogen. Nitrogen is readily leached from the soil and is rather quickly lost under systems of clean cultivation. Apple trees make heavy demands on the available nitrogen in spring during the blossoming and fruit setting period.

Too much nitrogen in the soil causes excessive vegetative growth with consequent lower yields of fruit which may be late in reaching maturity, poor in colour and of indifferent quality.

Phosphorus.

Large amounts of phosphorus are not required by fruit trees but this element is often of considerable importance for root growth. Orchard trees appear to be able to obtain phosphorus from the soil more readily than many other plants and store it for future use. Symptoms of deficiency are not common in the Stanthorpe area, where superphosphate is used to promote the growth of leguminous cover crops in orchards.

Symptoms of phosphorus deficiency are seldom seen in the orchard but affected trees characteristically produce small, narrow, dull, dark-green leaves, which later become bronzed; leaf stalks also develop purplish tints, as do the margins of the leaves. In spring, bud burst is markedly delayed and dying of buds is prevalent; leaf fall occurs earlier than usual.

Potassium.

Potassium is necessary for the manufacture of sugars and starches in both leaves and fruit and for proper root development. It also regulates the loss of water by the plant and helps in the building of proteins and therefore functions in conjunction with nitrogen. Potash accumulates in the fruit to such a degree that a tree may use the equivalent of two pounds of muriate of potash in the fruit alone. Despite this high rate of usage, fruit trees generally do not require heavy applications of potassium because the supply from the parent rock is adequate in most soils. Deficiency symptoms are, however, sometimes noted, especially in old orchards.

Lack of potassium is indicated by marginal scorching and the development of patches of dead tissue in the leaves, and as the dead tissue falls out they become ragged. Early defoliation of shoots occurs and usually begins at the tips. Potash-deficient trees do not show the same lack of vigour as those suffering from lack of nitrogen, though the shoots tend to be spindly. Fruit from affected trees is usually low in sugars and poor in colour.

Calcium.

Calcium is not only an essential nutrient element for the apple tree but the amount in the soil very largely determines its acidity and therefore the availability of various other nutrients to the plant. Under some circumstances, applications of lime are desirable at Stanthorpe. Trees lacking adequate supplies of calcium are characterised by leaves with irregular dark-brown blotches, which somewhat resemble the scorching caused by arsenical sprays. Sometimes the leaves turn reddish-purple prior to defoliation.

Magnesium.

Magnesium forms part of the green colouring matter or chlorophyll of the foliage, but Stanthorpe soils usually supply adequate amounts to meet the requirements of apple orchards. Occasionally, however, trees respond to applications of magnesium sulphate, particularly those growing in the more sandy soils.

Magnesium-deficient trees usually have large leaves which develop extensive chlorotic areas between the main veins; the older leaves are the first to be affected. Defoliation is premature and normally begins at the base of the shoot.

Sulphur.

In addition to the major elements referred to above, fruit trees also require fairly large quantities of sulphur and iron. Sulphur is usually present in the soil in adequate amounts and these supplies are supplemented by fertilizers such as ammonium sulphate, potassium sulphate and superphosphate, all of which contain this element.

Trace Elements.

Certain trace elements are necessary for normal tree growth, and though they are required only in minute quantities, they nevertheless influence tree health in a very marked degree. Apple trees show symptoms of zinc, boron and copper deficiency at Stanthorpe and corrective treatments must be applied in many orchards.

Zinc.

The main symptoms of zinc deficiency are a marked reduction or cessation of terminal growth, delayed leafing out of new growth and the production of rosettes of small narrow leaves (Plates 55 and 56). An early symptom is the mottling of the leaves with the development of yellow streaks and patches between the veins, but the main veins themselves usually remain green. In acute cases, the terminal parts of branches die back. Fruit produced on affected trees is small, and tree yields decline markedly. The condition is known as little-leaf.

Boron.

A lack of boron gives rise to a number of troubles, such as internal cork, superficial cork, corky core and measles. The first three of these disorders affect the fruit, and varieties differ in their susceptibility and symptoms. Thus, Granny Smith is particularly subject to internal cork and corky core (Plate 57), Jonathan to superficial cork and corky core, and Delicious to superficial cork.

At Stanthorpe, measles affects mainly Delicious and Jonathan trees and is characterised by pimples and small blisters on the bark of the young wood. Later the bark cracks and becomes very rough (Plate 58). Bark near affected areas is reddish in colour and red streaks may also appear in the wood.

Copper.

Early symptoms of copper deficiency are the cessation of growth at the tip of the current season's shoots (Plate 59) and the development of brown or reddish patches in the leaves. The tip of the shoot withers and dies and frequently curves to one side. The condition is not confined to terminal shoots on leader branches but may occur on

young shoots in any part of the tree. The bark of young affected trees commonly develops numerous fine cracks which give it a rough or scurfy appearance (Plate 60). No symptoms of this disorder have been observed in fruit.

Plate 55.
Zinc Deficiency in an Apple Tree. Appearance of leader terminals.

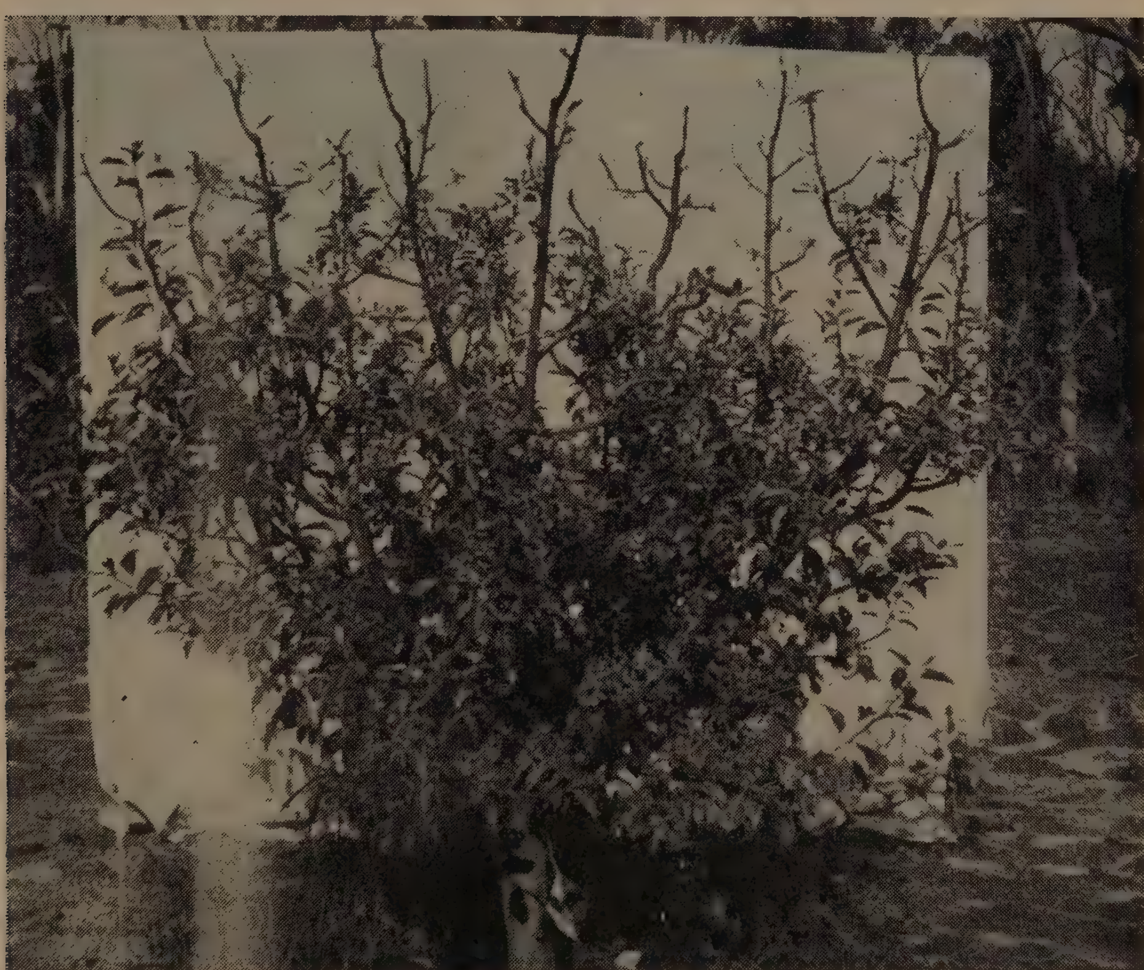

Plate 56.
Zinc Deficiency. Stunting effect resulting from the suppression of terminal growth.

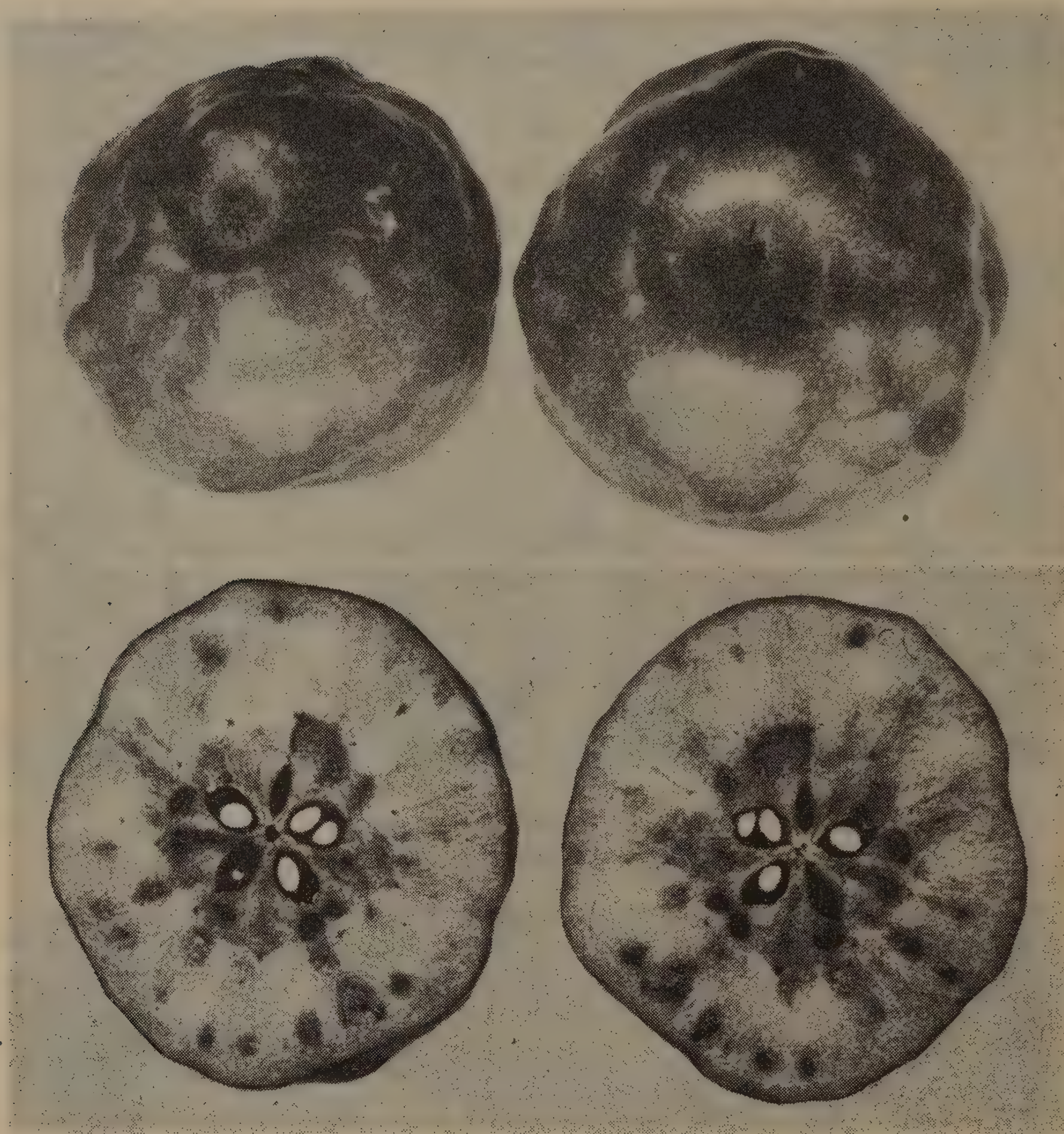

Plate 57.
Internal Cork in Granny Smith Apples.

Iron.

Iron plays an important part in the formation and maintenance of chlorophyll in the leaves. A deficiency is frequently associated with an excess in the soil of manganese or lime, both of which interfere with the absorption of iron. Foliage of trees lacking iron becomes chlorotic but the veins remain green.

Balanced Nutrition.

All of the elements mentioned above are essential for healthy tree growth. The relative amounts may, however, be much more important than the actual quantity of each. This balance between the several elements taken up by the plant depends on a number of factors, such as nature of the soil, soil management methods and the fertilizers used. It can be upset by lack of organic matter in the soil, extremes of acidity or alkalinity, and also by the continuous use of single-element fertilizers.

Plate 58.
Apple Wood Affected by "Measles." Variety—Delicious.

General Recommendations.

When assessing the fertilizer requirements of an orchard, the following general considerations should be borne in mind:—

(1.) Organic matter can best be supplied to an orchard soil as a winter green manure crop. It is usually necessary to fertilize such a crop with a 4:14:2 mixture applied at the rate of 2 to 3 cwt. per acre for legumes; and sulphate of ammonia at the rate of 1 to 2 cwt. per acre for cereals.

(2.) In spring, the nitrogen requirements of fruit trees are high and a turned-in cover crop may also draw heavily on soil nitrogen unless decomposition of the green matter is well advanced. It is therefore sound practice to apply to the trees a complete fertilizer mixture, high in nitrogen, late in the winter or early in spring. The application can be made immediately prior to or shortly after the cover crop is turned in. A 10:8:7.5 or similar mixture is suitable. The suggested rate of application is ½ lb. for each year of age of the trees with a maximum of 10 lb. per tree per annum. Vigorous trees making a large amount of vegetative growth should receive less nitrogen, and a mixture such as 5.5:13:5 may then prove more suitable. Mixtures containing less phosphoric acid than the above fertilizers could be used when they are available.

Plate 59.
Copper Deficiency of Apple. Withering and defoliation of young shoots.

The spread of the roots in apple trees is much wider than that of the above-ground portions of the tree. Therefore fertilizer must be distributed widely and evenly so that it will be available to the whole root system. In mature trees, the roots are usually most numerous from about three feet to about 15 feet from the trunk.

(3.) At the time of fruit bud initiation in December and January, the demand for nitrogen is not as great as when fruit setting takes place in spring. However, during the summer months bearing trees require an adequate nutrient supply for bud development, further growth

and storage of plant foods, and in Stanthorpe orchards an application of some such mixture as 4:12:6 is advantageous. The application should be made in December at the rate of ½ lb. fertilizer for each year of age of the tree.

Plate 60.
Copper Deficiency of Apple. Scurfiness of the bark.

(4.) Many Stanthorpe soils are rather acid. An occasional application of lime or dolomite would reduce the acidity and thereby help to make other plant foods available to the trees; it would, moreover, supply calcium if required. Liming can be done either a few weeks after the late winter fertilizing (say in mid-September) or when the land is prepared for a green manure crop in February. An application of one ton per acre of either pulverised limestone or dolomite should effect the required change of acidity in a sandy soil. Treatment should be preceded by a pH determination of the soil and should be followed by periodical tests to check acidity trends.

(5.) Trace elements must be applied in many orchards to maintain the vigour of the trees. Methods of correcting deficiency symptoms and preventing their recurrence are:—

Zinc.—In winter, the trees are sprayed with 20 lb. zinc sulphate in 80 gallons water for two years in succession; in severe cases, a double strength spray may be used in the first year. Thereafter, the spray is applied in alternate years.

Boron.—In late winter, borax is applied to the soil at the rate of 4 oz. per tree. The borax should be mixed with fertilizer or sand to ensure a relatively light and even distribution, as concentrated borax is injurious to roots. Alternatively, trees may be sprayed about November with 4 lb. borax in 80 gallons water. A single soil application is effective for some years, but spraying may have to be repeated more often.

Copper.—Trees may be supplied with this element by applying copper sulphate (fine crystals) to the soil in late winter at the rate of ½ lb. per tree for bearing trees, or 2-4 oz. for young trees. Trees which are regularly sprayed with a copper fungicide, such as Bordeaux mixture, seldom need the soil dressing. Treatment is usually effective for several years.

HARVESTING.

Probably the most reliable outward sign of approaching maturity in the apple is the changing of the green ground-colour of the fruit to a yellow-tinted green, or a lighter shade of green. At this stage, the texture of the flesh becomes more crisp, and both juice and sweetness increase. A change in the colour of the seeds from cream to brown is not always a reliable indication of maturity, as it may take place before the fruit is ready for picking.

Ripening is accompanied by the formation of an abscission layer of cells at the base of the fruit stalk. As a result, the connection of the fruit with the tree becomes weaker as ripening proceeds until picking is relatively easy. The abscission layer develops rapidly in some varieties, such as McIntosh and Gravenstein, and the fruit is liable to fall as soon as it is mature; in other varieties, such as Delicious, it may develop so slowly that the fruit hangs beyond the correct picking stage.

Apples are often picked for culinary purposes before they reach maturity and are marketed when they reach a suitable size. If picked too early, however, they may wilt severely. Fruit for dessert use should not be picked until the flesh has become palatable. The correct stage of maturity at which to pick apples for storage and distant markets requires careful judgment, for much depends on the variety grown and the district in which the fruit is produced.

Picking Methods.

Almost invariably, apple trees are picked over several times before the whole crop is gathered. All fruit must be handled carefully to avoid bruising and close supervision of pickers is therefore necessary. Points to be watched include:—(1) fruit should be picked with a twist so that the stalk is retained; (2) fruit should be placed in the picking bag, not dropped into it; (3) fruit in picking bags must not be pressed against the ladder during picking; (4) fruit should run out gently in a steady stream when the bags are emptied; (5) fallen fruit should not be included with picked fruit; (6) field cases should not be over-filled; (7) field cases can profitably be lined with strawboard; (8) fruit for storage or distant markets must be handled with special care, as even long finger nails can cause skin injury and blemish.

When making up special consignments, it is well to remember that fruit from young trees and large fruit from any tree are unsuitable for long cold storage; sandy soils usually produce fruit which stores well, particularly if the soil nitrogen is relatively low. Red colour develops most in fruit which is exposed to the sun and can usually be increased by spreading out the fruit under the trees in partial shade. This practice, however, is seldom necessary at Stanthorpe, where conditions are usually favourable for the development of colour.

Pre-harvest Fruit Drop.

Dropping of nearly mature fruit is at times prevalent in varieties such as McIntosh Red, Gravenstein and Jonathan, and can cause serious losses. Fortunately, this pre-harvest fruit drop can be prevented by the use of hormone sprays, particularly alpha naphthalene acetic acid and related chemicals. The hormone is absorbed into the tissues of the fruit stalk and strengthens its union with the tree. The spray is applied at a strength of 5 to 10 parts per million in water, a few days before dropping usually commences or at the first sign of dropping. The effect of the treatment may extend over as long as three weeks, but this period may be less in the case of McIntosh, Delicious and some other varieties. To be fully effective, the hormone must reach the stalk of the fruit, and thorough spraying is therefore essential with special attention to the fruits themselves.

Ripening processes are not in any way retarded by the spray, and the fruit may be held on the tree beyond the optimum stage at which it should be picked for marketing or cool storing. Care must be taken, therefore, to avoid delaying harvesting until this stage is reached.

Preparation for Market.

High quality fruit must be attractively presented on the market if it is to command the best price. Apart from flavour and keeping quality, important factors which influence price are the appearance of the fruit itself and the manner in which it is displayed in the packed case. The appearance of the fruit in the case is greatly enhanced if it is well graded and, consequently, uniform in size, and if it packed evenly and firmly. Apple growers who prepare their own fruit for market therefore require facilities for handling it efficiently; this involves the provision of a roomy packing shed supplied with case-making devices, grading machinery and other equipment.

Apples are packed in either the Australian dump case or the standard case for home and overseas markets. The fruit carries best if it is wrapped and if the case is lined with corrugated cardboard.

Improvement of Mandarins.

New plantings of citrus on the Department's horticultural block at Gatton Irrigation Research Station are intended largely for mandarin improvement purposes.

The existing budwood block of the popular Emperor variety is to be extended. In addition, an area is to be planted with mandarins grown from seed of hand-pollinated flowers, from which it is expected that budwood of new and improved hybrid varieties will be made available to nurserymen and growers. A further area will be planted with nucellar seedlings of the A grade varieties now grown in the State. By the use of nucellar seedling trees as a source of budwood, greater production is hoped for, as these seedlings are free from the virus diseases responsible for citrus decline.

Approved Strawberry Runners.

WITH the objects of reducing the occurrence of strawberry virus diseases and improving the general quality of strawberry planting material, the Department of Agriculture and Stock has for some years past been operating an approval scheme for strawberry runners.

The crops of the following growers were inspected during the past season and found to be free or practically free from virus diseases and to be grown under good cultural conditions. These growers may now sell their runners as "Approved by the Department of Agriculture and Stock."

Grower.	Address.	Variety.
W. G. Muller	Western road, Woombye	Phenomenal
A. J. C. Armstrong	Old Bowling Green road, Palmwoods	Phenomenal
G. A. Armstrong	Old Bowling Green road, Palmwoods	Phenomenal
C. L. Tompkins	Old Bowling Green road, Palmwoods	Phenomenal and Aurie
G. H. Rose	Anzac avenue, Kallangur	Phenomenal
A. Fels	Underwood road, Eight Mile Plains	Phenomenal
W. N. Gibbs	Grieve road, Rochedale	Phenomenal
A. R. Boyce	Pineland road, Sunnybank	Phenomenal
E. H. Lambley	Birkdale	Phenomenal
J. A. Elliott	Allenby road, Wellington Point	Phenomenal
A. J. Morris	Ormiston	Phenomenal
R. J. Hucker	Princess street, Cleveland	Phenomenal
D. J. Brown	"Berryville," Cleveland	Phenomenal
W. E. and E. K. Burns	Bloomfield street, Cleveland	Phenomenal
G. Lax	Pinklands, *via* Cleveland	Phenomenal
G. H. Palmer	Redland Bay road, Victoria Point	Phenomenal

RADIO TALKS TO FARMERS
(Australian Broadcasting Commission)
4QR AND REGIONAL STATIONS
THE COUNTRY HOUR—Daily from 12 noon to 1 p.m.
4QG AND REGIONAL STATIONS
COUNTRY NEWS MAGAZINE—Every Sunday at 9 a.m.

Botulism in Poultry.

J. J. McLACHLAN (Poultry Adviser) and L. G. NEWTON (Officer-in-Charge, Animal Health Station, Oonoonba, Townsville).

OUTBREAKS of botulism, sometimes causing heavy mortality, occur in most years in this State, particularly among farm flocks along the tropical coast. During 1950, in the Townsville district alone, 13 outbreaks were investigated; about 2,000 birds were involved, of which 1,000 died. As by no means all outbreaks are reported, it is obvious that the disease is responsible for much greater wastage than is generally realised.

Cause of the Disease.

Botulism is caused by a bacterial poison produced by *Clostridium botulinum,* an organism which is widely distributed in the soil. In the presence of rotting animal or vegetable matter the organisms multiply rapidly, especially in hot, humid conditions, and produce an extremely powerful poison. Some idea of its deadliness is demonstrated by the fact that one drop is sufficient to kill 600 mice. It is one of the few

Plate 61.

Decaying Bodies of Birds that have Died from Botulism Become a Further Source of Infection. Prevent further losses by burning such carcases.

Photo. U.S. Department of Agriculture.

bacterial toxins able to kill when taken in through the mouth, and consequently when decomposing materials, maggots or foodstuffs containing or contaminated with the toxin are eaten the disease develops. Shallow lagoons and water holes containing much decaying animal or vegetable matter may build up in toxin content to such an extent that the water itself causes botulism.

The outbreaks briefly described below are typical of the circumstances in which the disease occurs.

(1) A farm flock scratched out and ate the decomposing flesh of a partly buried pig. Twenty deaths occurred. Maggots and rotting flesh were found in the crops. Washings from the crop administered to test guinea pigs caused death after typical symptoms of botulism.

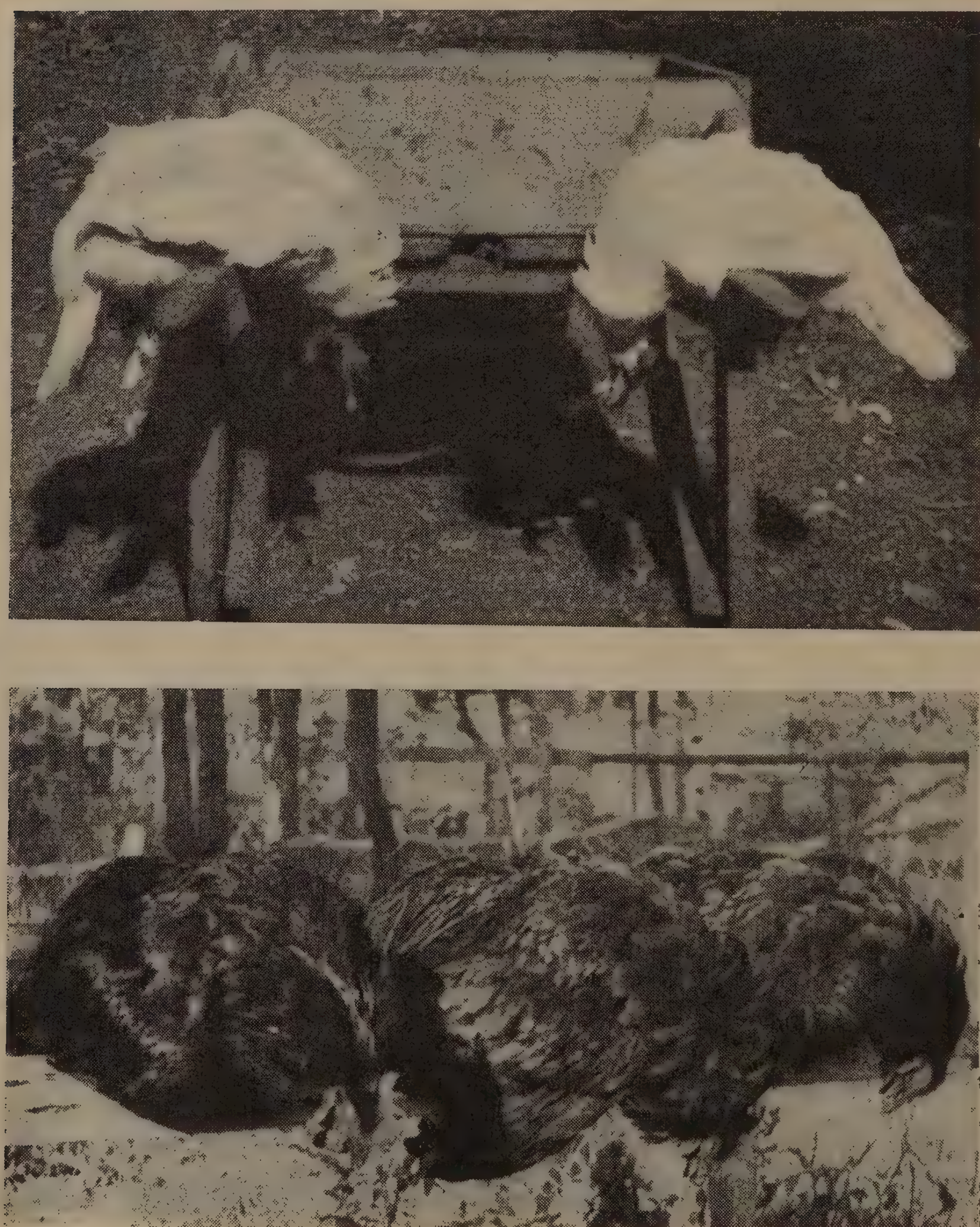

Plate 62.

Affected Birds. Note the position of the heads. All the birds shown subsequently recovered.

Plate 63.

Looseness of the Feathers Indicates Botulism. The bare patch on the back was caused by attempting to lift the bird by the feathers.

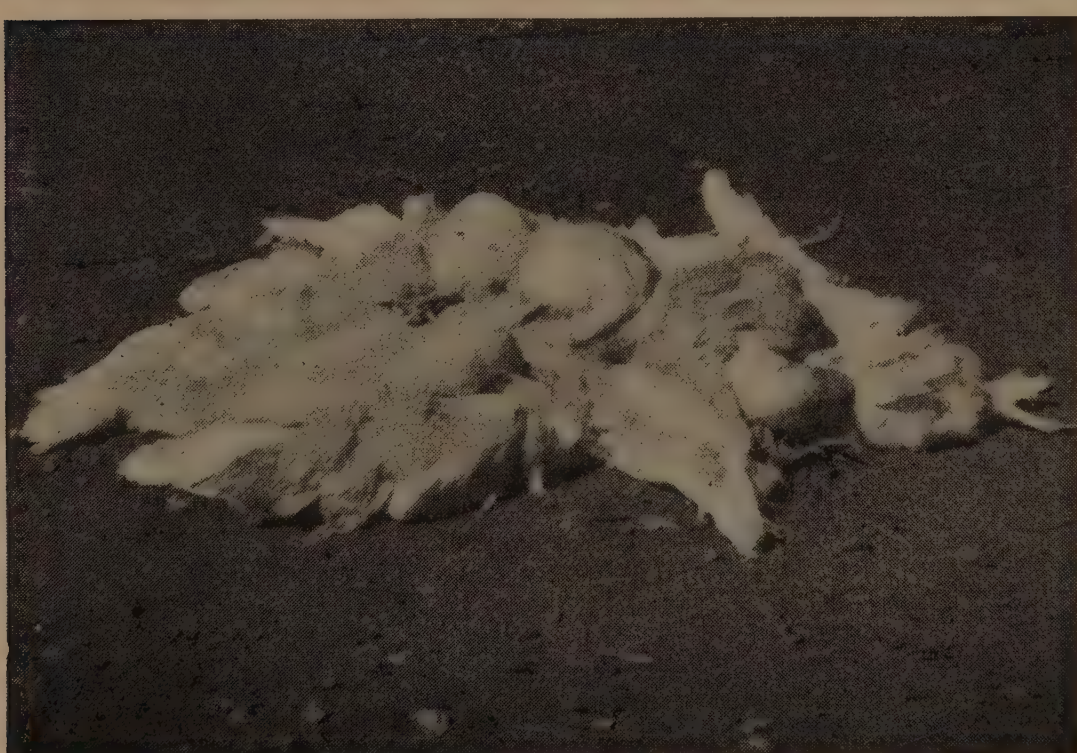

Plate 64.

Twenty-five Dead Birds all of Which Appeared Healthy and Well the Previous Afternoon, Indicating Rapid Course of the Disease.

(2) The flesh and internal organs of a dead fowl, incompletely burnt, were eaten by fowls on a commercial farm. Ten died. The crop contents contained decomposing flesh and bowel. Laboratory tests confirmed the diagnosis of botulism.

(3) A flock of ducks consumed some evil smelling liquid spilled from a garbage can. Four died overnight and the remaining 30 birds were severely affected. Laboratory mice injected with blood serum from the dead birds died in a few hours, indicating that large amounts of botulinus toxin were present.

Birds Affected.

All classes of poultry and birds are affected. Heavy mortalities have occurred in ducks and other wild fowl. For example, in the United States of America an outbreak in wild ducks occurred in 1932 in which it was estimated that there were 8,000 to 10,000 dead birds per mile for six to eight miles along the shore and in the marshes bordering the Great Salt Lake in Utah.

The disease occurs more often in farm and back-yard fowls than in commercial flocks, because they are more likely to have access to decaying or rotting material while ranging for food. In mixed flocks, a higher percentage of ducks and turkeys than fowls is usually involved in an outbreak of botulism, because ducks and turkeys move in more compact flocks and if toxin material is found it is shared amongst a larger number.

Effects Produced by the Disease.

The toxin acts on the brain and nerves, interfering with their normal function, and symptoms are not shown until it is carried to those sites. For this reason, there is a delay of from 12 to 48 hours from the time the material containing the toxin is eaten until sickness is evident. Symptoms may then develop rapidly and the suddenness of their appearance is a feature of the disease; in a flock apparently normal at night, there may be numerous deaths and sick birds by the following morning.

In the early stages of the illness the bird is dull and disinclined to move; this is followed by loss of power in the legs, wings and neck, and in the final stages the bird is completely paralysed in a sitting position with the head on the ground. If the bird is lifted the head falls limply. For this reason, the disease is often referred to as "limber-neck." Greenish yellow or whitish diarrhoea is often seen. The eyes are half closed, a thick greyish saliva escapes from the beak, and as the disease progresses breathing gradually becomes slower. Finally, death occurs either quietly or after several convulsions. The comb and the flesh darken rapidly after death.

A characteristic feature of the disease is the ease with which the feathers can be pulled out, large numbers coming away when sick or recently dead birds are handled.

Post-Mortem Examination.

In most cases, post-mortem examination reveals little change from normal. There may be small haemorrhages around the heart and the lungs and intestines are sometimes congested. The main value in opening up the birds after death is that the material causing the toxin (flesh, maggots or refuse) may be found and so assist in making a correct diagnosis.

Diagnosis.

Botulism is diagnosed on the following findings:

(1) Sudden onset of sickness with diarrhoea, paralysis of the legs and wings and "limberneck," often resulting in heavy mortalities.

(2) The feathers can be pulled out very easily.

(3) The absence of marked changes in the body after death.

(4) The presence of maggots or decomposing material of any sort in the digestive tract or a history of access to such material.

(5) As on many occasions toxic material may not be found, affected or freshly dead birds should always be sent to the Animal Health Station at Oonoonba or Yeerongpilly for confirmation of the diagnosis.

Differential Diagnosis.

In making a diagnosis, the disease must be differentiated from:

(1) *Spirochaetosis.*—This disease closely resembles botulism, since paralysis of legs, wings and neck and diarrhoea are constant features. Post-mortem changes in spirochaetosis, however, are more marked and the spirochaetes are present in blood films.

(2) *Salmonellosis.*—This disease may be confused with botulism in ducks. Salmonella organisms, however, can be cultured from the tissues.

(3) *Leucosis.*—The paralysis in this disease develops more slowly and "limberneck" is unusual. If the flock is examined, some birds will be found with other lesions, such as distorted pupils or "pearl" eyes.

What to Do in an Outbreak.

Prompt action along the following lines will minimise losses in an outbreak of botulism:

(1) Confine the whole flock to a shed or fowlhouse. This applies particularly to farm flocks which range during the day and perch in a house at night. Confinement prevents further access to toxic material.

(2) Provide ample fresh drinking water to which has been added Epsom salts at the rate of two ounces per gallon. This helps to rapidly eliminate toxic material from the digestive tract.

(3) Search for and destroy by burning or deep burying the decomposing material which is the source of botulinus toxin. Likely materials are dead animals or birds, fertilizer which has been wet, rotting vegetables, mouldy foodstuffs and kitchen scraps.

(4) Contact the nearest officer of the Department of Agriculture and Stock for advice.

(5) Send one or more typically affected birds or suspected material, well packed, to the Animal Health Station at Oonoonba or Yeerongpilly. Diagnosis can usually be confirmed in 24-48 hours by laboratory tests if suitable material is sent.

THE 1951 DAIRY FARM COMPETITION RESULTS.

The Minister for Agriculture and Stock (Hon. H. H. Collins) recently announced the results of the second dairy farm competition conducted by the Department under the Commonwealth Dairy Industry Efficiency Grant.

The prize winners were as follows:—

Zones 1 and 2 (Brisbane, near North Coast and South Coast districts): E. D. Lawley and Son (Maleny), 1; Estate A. Alcorn (Maleny), 2; F. J. Fleiter (Conondale), 3.

Zones 3 and 4 (Maroochy and Gympie districts and part of the South Burnett): T. A. McNaught (Pound Hill, Gympie), 1; F. H. Sippel (Redgate, via Murgon), 2; Allen and Sons (Chatsworth, via Gympie), 3.

Zone 5 (Kingaroy and Nanango areas and parts of Rosalie and Esk shires): T. J. Champney (Crawford), 1; A. Royle (Coolabunia), 2; V. Voight (Booie), 3.

Zones 6 and 7 (Isis to Rockhampton): Muspratt and Sons (Littlemore), 1; Lehfeldt Bros. (Kalapa), 2; N. J. Larson (North Bundaberg), 3.

Zone 8 (Mackay district): G. E. Muller (Mackay), 1; W. Menkens and Son (Home Hill), 2; G. Cole and Sons (Alligator Creek, via Mackay), 3.

Zone 9 (North Queensland): R. S. Griffiths (Moregatta), 1; H. Sigley (Jaggan), 2; Stephenson Bros. (Jaggan), 3.

Zone 10 (Ipswich, Brisbane Valley and Lockyer districts): H. L. Stark (Kalbar), 1; J. P. Schlecht (Walloon), 2; J. Egan (Toogoolawah), 3.

Zones 11 and 12 (Toowoomba-Warwick and some of the surrounding districts): R. J. Browne (Yangan), 1; A. E. Pechey (Pechey), 2; P. J. Evans (Warwick), 3.

Zones 13 and 14 (Rest of Downs and Maranoa): I. B. Skerman (Kaimkillenbun), 1; C. H. B. Huey (Sabine), 2; J. Schull and Sons (Oakey), 3.

Zone 15 (Central and Upper Burnett): B. J. Ostwald (Monto), 1; C. G. Luthje (Monto), 2; Mrs. A. A. Elliott (Monto), 3.

Zone 16 (Banana and Mt. Morgan districts): W. Lawrence (Dululu), 1; L. and A. Goos (Valentine Plain), 2; Leeke Bros. (Thangool), 3.

The Overfat Pig: Causes and Remedial Measures.

T. ABELL, Adviser, Pig Branch.

THE pig industry in Queensland today is past the stage when pig keeping was simply a convenient method of disposing of otherwise useless farm residues, though many pigs are still reared with that object in view. The higher prices now being received for pigs, together with the considerable increase in the values of various farm residues, demand that pig raising be placed on an equal business footing with other types of farming. Under present day conditions, should it be necessary to purchase feedstuffs for pigs, it becomes a matter of stern economical necessity to obtain the maximum possible returns in the form of pork or bacon. Any factor which reduces the ultimate net return should be eliminated.

Higher prices of human foodstuffs tend to increase the demand by consumers for quality, and this is a most important consideration in the local and export pork and bacon markets today. Though supplies of pork, bacon and ham are below those of a few years ago, consumers are, because of the higher prices, disposed to seek out the good quality products, thus making it more difficult to place overfat pork and bacon. Therefore, to assist in maintaining a high return for their pigs, farmers should make every endeavour to produce stock which will meet consumers' requirements.

In Australia to-day the overfat pig is unwanted by either the processor or the consumer, and though it is not generally realised is responsible for lowered returns to the producer.

The producer loses by receiving a lower price when pigs are sold at auction or paid on a weight and grade basis, by waste of feed used to grow the extra fat, by waste of time and energy spent in feeding the pigs too long, and by carrying fewer pigs than might otherwise be practicable. The processor pays meat price for fat, and has difficulty in marketing overfat products, which often require additional handling before sales can be made. Handling and storage charges are thus increased.

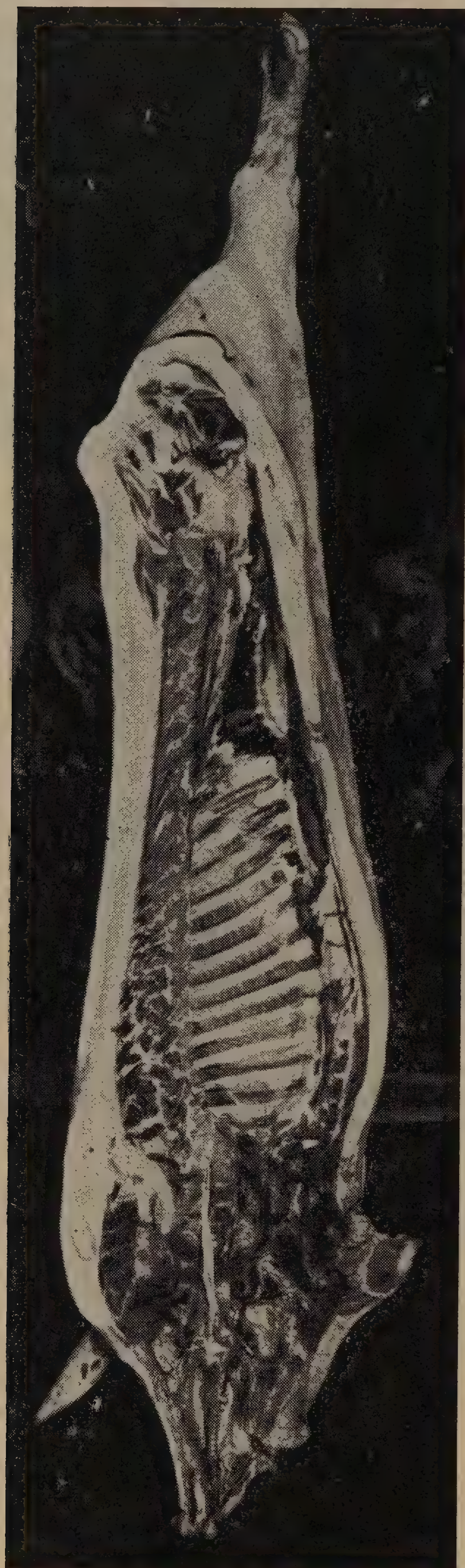

Plate 65.

Side from Overfat Baconer Pig (150 lb. dressed weight), Showing Excessive Backfat.

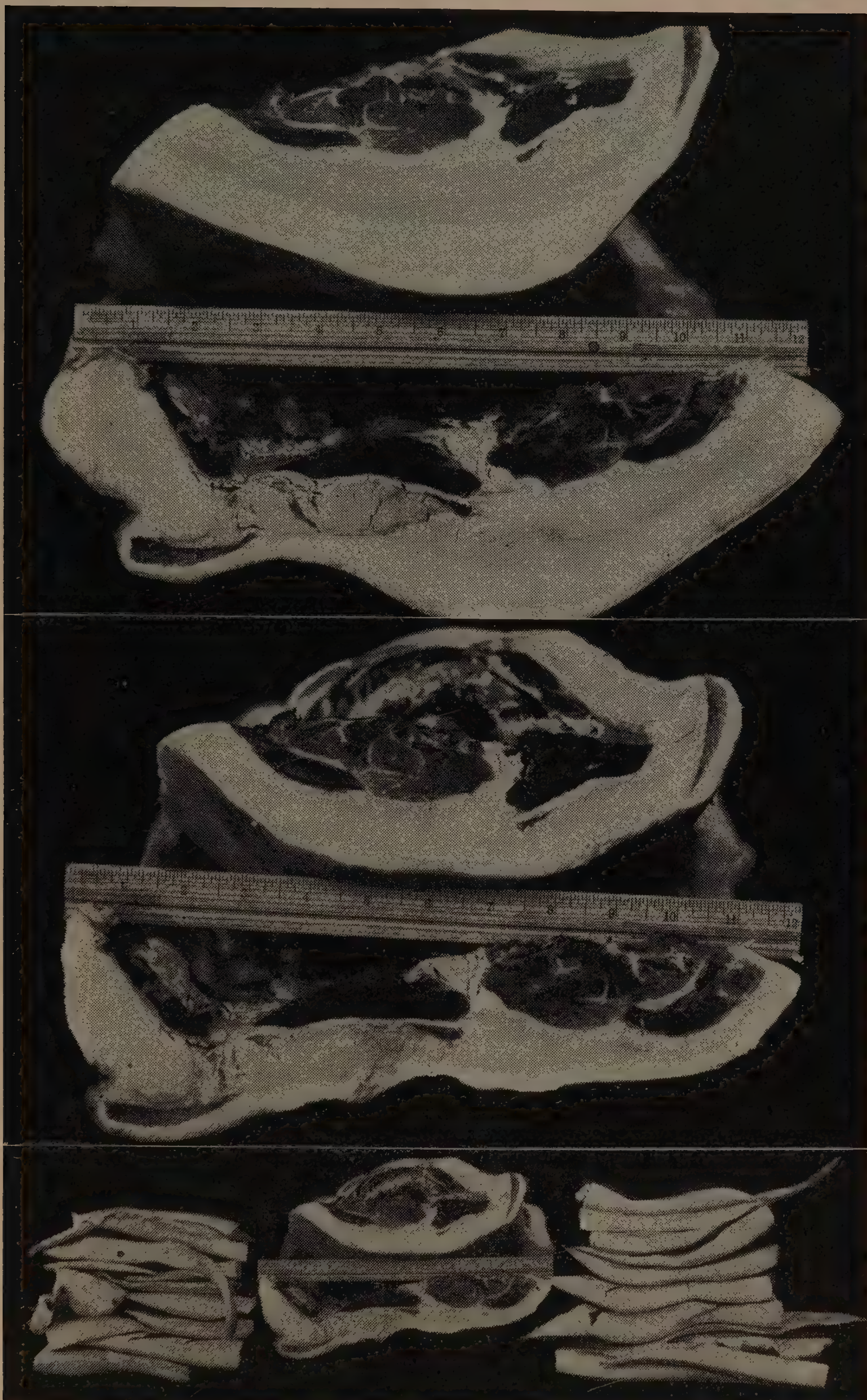

Plate 66.

Loss Due to Overfatness. Top, trade cut dividing the side into ham and flitch, showing excessive backfat extending down the side; centre, the same side defatted to trade requirements; bottom, the excess fat (14 lb.) cut from the overfat side—bought by the factory at two shillings per lb., this will realise only tenpence per lb. after processing for lard.

Plate 67.

Sides Showing Differences in Fat Development.

The percentage of overfat pigs being marketed at present is the cause of much concern to all sides of the industry, and particularly as it is more profitable to rear fast growing pigs of the correct type, it is urgent that all pig raisers give serious thought to eliminating the overfat pig. It is not an expensive matter or a difficult problem if approached correctly, but the remedy lies chiefly in the hands of farmers themselves.

The pig raiser should go through his piggery and conduct a searching inquiry along the lines set out below. By so doing he can improve his standard of efficiency, increase his returns and at the same time do much to eliminate complaints from processors and consumers.

Are the Breeding Stock Suitable?

Whether the breeding stock is bred on the farm or purchased as weaners or stores, the answer to this question is of major importance. Poor type breeders are a major cause of overfat pigs, both porkers and baconers, in Queensland. The first decision to make is whether to produce porkers or baconers; breeding stock should then be selected accordingly. This applies whether a farmer breeds weaners or stores or carries his pigs through to market.

It is useless trying to produce quality baconers from porker type pigs and *vice versa,* and this should be borne in mind when selecting breeders. Therefore, pigs of long, lean, late-maturing types should be used for producing baconers, and breeders of an early maturing type to produce porkers. It is most important to remember that *type is more important than breed,* as off-types of any breed will not give the results that correct type pigs will.

Whatever breed or cross is used, it is desirable to see the parents of stock under consideration as breeders, for if the desired characters are present in them as well as in their offspring it heightens the prospect of those characters appearing in the next generation. If possible, it is useful also to sight near relatives at a stage when their weight is about that at which it is intended to market the pigs that are bred.

Overuse of crossbreeding is to be avoided, as it results in uneven litters that do not develop uniformly. This makes it difficult to avoid finishing with some overfat pigs.

Is the Feeding Correct?

Next in importance to suitability of type is correct feeding. Each year thousands of pigs are marketed in an overfat condition simply because they were not fed correctly. Even pigs of correct type can be made overfat by bad feeding.

At birth the pig has a relatively large head, long legs and small body with little loin or fat. The head makes most of its growth early in life and attains its maximum size while other parts of the body are still growing actively. The limbs also make most of their growth early in life, but the body itself, and particularly the region of the loin, grows slowly and is much later in maturing. Apart from these differences in rate of growth of parts of the body, it has to be remembered that bone develops faster than muscle (lean) and fat is slower in developing than either. Young animals are furnished with more bone and muscle and less fat than are older animals. It is not

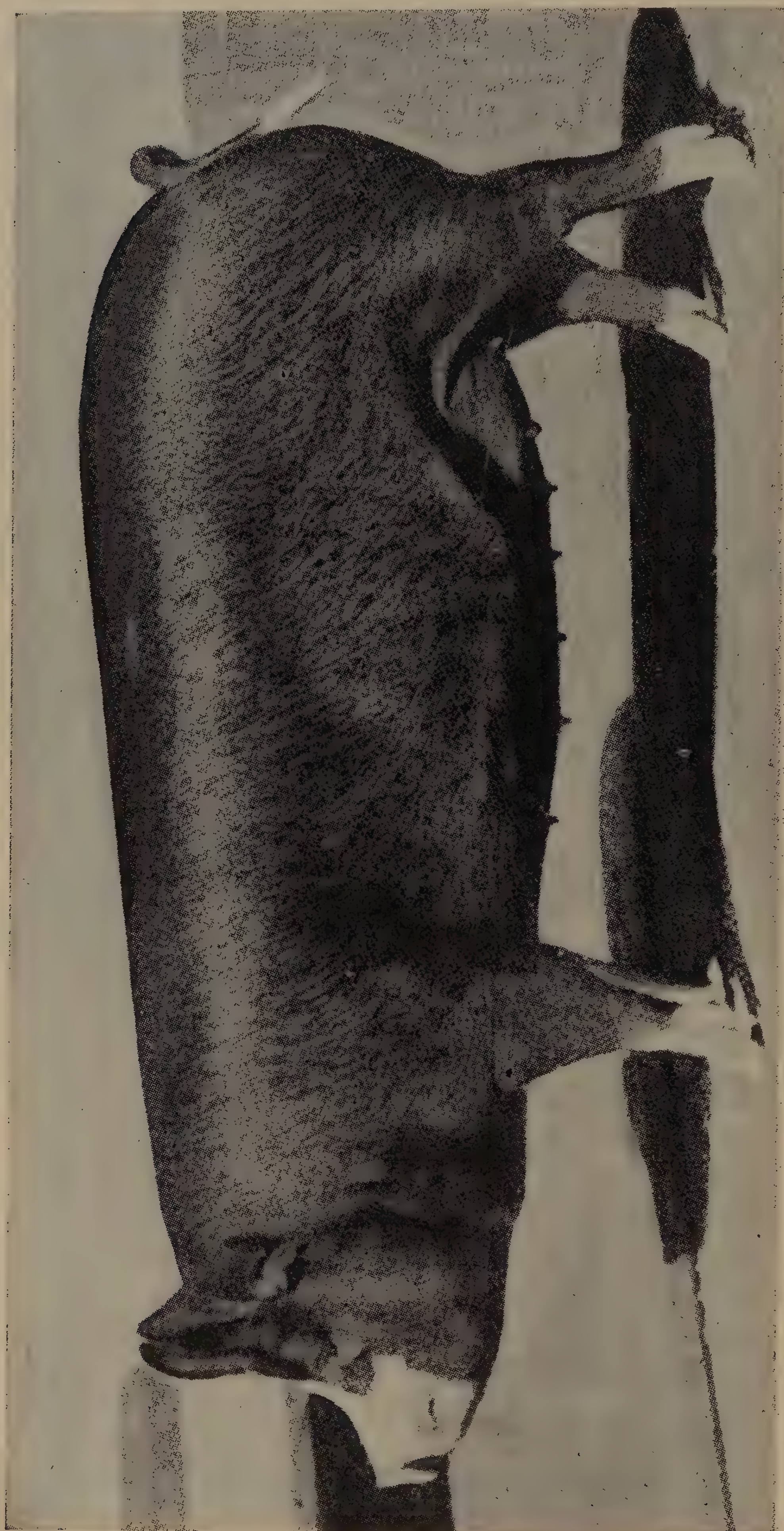

Plate 68.

A Baconer of the Correct Type.

surprising, therefore, that feeding pigs well when young causes an increase in length of body and that restricting the food intake towards the end of the growing period reduces the amount of fat in the body and so assists materially in producing good bacon pigs. On the contrary, if young pigs are underfed early in life and overfed later, they finish up as short and overfat and moreover consume more food before reaching bacon weight.

Feeding of the in-pig sow during the later stages of pregnancy influences the birth weight of the litter. Piglets developing in the womb make most rapid growth during the few weeks prior to birth, so it is important that the food intake of the sow be stepped up at that time.

Is the Piggery Management Sound?

Results to be expected from the use of good stock and sound feeding practices can be upset by faulty management. Pigs should be managed so that they are given every opportunity to grow to the limit of their inherited capacity and any management practice which prevents such growth should if at all possible be eliminated.

Care should be taken to ensure that each pig has room to feed, and that no sudden changes are made in the ration. Grading of pigs into lots of approximately the same size is very important. It allows of each pig getting an equal opportunity at feeding time, especially if ample trough space is provided. Mating should be arranged to fit in with seasonal feed supplies unless provision is made for storage or purchase of some feed.

Early castration (at 3-4 weeks) and creep feeding help to produce big weaners.

Paddocks should be spelled in rotation and the management of the piggery generally should aim at regular growth in stock and guard against periods of feed scarcity that bring slower growth and subsequent tendency to overfatness.

When are the Pigs Marketed?

The marketing of pigs at a pre-determined weight or age is another common cause of overfat pigs. Only when stock and conditions are standardised can this be safely attempted. Many factors can create poor results with such a policy. For instance, early-maturing type pigs which are "finished" at 120 lb. are often carried on to 160 lb. to secure a higher gross price. Such pigs almost invariably dress out overfat. Checks in growth during the growing period will upset the average weight at a set age, and tend to produce overfat pigs, especially in the higher weight ranges. Where mixed types are used as breeders more trouble can be expected than with a uniform line of breeders, owing to the greater variation in growth between pigs in any one litter.

As pointed out earlier, pigs go through two main stages of development, and it is during the latter stage, when the pig has the required amount of finish, that it should be marketed, *irrespective of weight and age.*

Is the Piggery Accommodation Satisfactory?

As with faulty management, poor accommodation can undo the good established by sound feeding of correct type pigs. Whether an intensive or a grazing type piggery is concerned, there are certain

essentials whch must be provided to ensure health and growth in the stock. Protection from heat, cold, and wet should be available to the pigs and a reasonable standard of hygiene maintained. If these things are not provided, maximum growth cannot be expected, and more feed and time are required to rear the pigs. Conditions are also created which allow factors mentioned earlier to operate, thus making it difficult to avoid producing overfat pigs.

Plate 69.

Self-grading Feeding Floors and Farrowing Pens.

Are Seasonal Feed Supplies Used Correctly?

The seasonal nature of the supply of many foodstuffs gives rise to many overfat pigs. During seasonal feed shortages it is too often noticed that pig raisers increase the ration to older pigs at the expense of younger ones in an endeavour to get the former to the factory as

soon as possible. This is an ill-advised and wasteful process. Stepping up the food instake of the older pigs can have only one result—overfatness. This is especially so if they have been on short rations previously and suffered a check in growth. On the other hand, the small pigs which have been given a reduced ration will have their growth checked and when they are put back on full feed will tend to develop fat instead of bone and muscle.

If the food supply is decreasing, there are three courses to follow to gain the maximum results from the pigs on hand:—

(1) Purchase food so that all pigs have an adequate ration. If this is done, a greater proportion of the more concentrated foods is best fed to the younger pigs and a greater proportion of the bulky foods to the older ones. The ration, of course, must still be balanced, but the bigger pigs can handle bulky foods better.

(2) If a satisfactory market can be found, sell some young or store pigs.

(3) Sell any pigs of factory weight and grade as soon as possible, even though they may be lighter than usual.

If (2) or (3) cannot be arranged, it is cheaper in the end to purchase food and finish all pigs rather than try to keep underfed stock.

The practice of taking pigs on to heavier weights than normal during periods of over-supply of feed is responsible for the production of many overfat pigs. In addition, returns are lower than they are if the pigs are marketed as soon as they are finished and the surplus food given to other pigs coming on in their place.

If it is necessary to purchase pigs during these periods in order to use the feed to best advantage, the economics of the matter require special consideration, but in general it can be stated to be a sound practice. A piggery should be stocked according to the average food supply available, and adjustments of feed or stock made in ample time to take care of fluctuations.

Are the Pigs Healthy and Vigorous?

Healthy, vigorous pigs will naturally make much better use of available food supplies than weaklings or sick pigs. Pigs that have recovered from sickness often fail to grow satisfactorily, and there is a similar result to that arising from underfeeding when small—namely, a tendency to run to fat quickly. Pigs that are infested with worms make only slow progress at a time when they should be growing rapidly and so the end result is the same as with pigs recovering from sickness. Thus disease in the piggery leads to slower growth, greater food requirements per pound of liveweight gain, greater production costs, and a tendency to produce overfat pigs.

Services Available to Pig Raisers.

The Department of Agriculture and Stock has Advisers in Pig Raising located in the principal pig raising areas of the State. These officers make inspections of piggeries with a view to determining the factors which cause trouble and advising on their elimination. In addition, they make inspections of pigs at slaughter and report back to pig raisers on the quality and grading of their pigs. From time to

time the Department co-operates with various organisations in conducting carcase competitions. By taking part in these competitions pig raisers can obtain a detailed and expert appraisal of their product as well as a comparison with that of other pig raisers. This gives valuable information on the quality of one's pigs and indicates what changes are required in management and marketing practices.

In North Queensland during the year 1944-45 only 48.6 per cent. of all pigs handled by the Northern Pig Marketing Board were classed as first grade; in 1950-51, with over 1,000 more pigs handled, the percentage of first grade pigs was 85.7. This great improvement has been due mainly to an arrangement whereby whenever pigs are received in an overfat condition, the pig raiser concerned is advised accordingly and encouraged to rectify the fault in the next consignment. A visit is generally made to the farm by the Adviser in Pig Raising in the area and the factors responsible for the overfat pigs determined. The Pig Board and Bacon Factory staff encourage the farmer to watch his pigs killed and see for himself how they look when dressed. Farmers are further encouraged to enter carcase competitions or have an appraisal done on one particular pig in a consignment. The pig raiser then obtains valuable information which enables him to improve the quality of his stock, decrease losses from disease and parasites, and save feed.

Pig raisers who are interested have the power to save themselves much time and money that are now lost each year through the production of overfat pigs. Elimination of overfat pigs causes no hardship but on the contrary effects considerable all-round improvement in returns.

Onion Seed Testing.

A reminder of the value to growers of the free seed testing service provided by the Department is given.

As the season for sowing onion seed is now at hand, the reminder is particularly timely to onion growers. Last year many onion growers found that the seed they purchased failed to germinate. Unfortunately, complaints which were made to the Department were lodged a long time after the seed had been purchased, thus making it difficult to take any action against the supplier.

Growers are therefore urged to submit samples immediately on taking delivery of the seed. At least 400 seeds should be submitted to the Department, the sample being marked with the name and address of the sender, quantity purchased, date of purchase, and name and address of the seller. The samples should be addressed to the Standards Officer of the Department of Agriculture and Stock, William Street, Brisbane, and be accompanied by a short covering letter. Germination results should be available within approximately one week from the receipt of the sample.

Brucellosis Testing of Swine.

The Department of Agriculture and Stock is operating a scheme whereby pig herds are tested at intervals for the occurrence of swine brucellosis (contagious abortion).

A herd listed by the Department as "brucellosis tested" is one in which all such animals as may be determined by the Director of the Department's Division of Animal Industry have been subjected to two successive tests for brucellosis, at intervals determined by him, without any positive reactors being found.

In order for a herd to be retained on the list of Tested Herds, a semi-annual or annual re-test of the herd, as determined by the Director, is required. If at a re-test any animal gives a positive reaction to the test the herd is removed from the list; it is not listed again until subsequent tests, as determined by the Director, have been carried out.

Full particulars of the Brucellosis Testing of Swine and application forms may be obtained from the Under Secretary, Department of Agriculture and Stock, William Street, Brisbane.

TESTED HERDS.

(AS AT 21st JANUARY, 1952.)

Breed.	Owner's Name and Address of Stud.
Berkshire	S. S. Ashton, "Scotia" Stud, Pittsworth
	J. J. Bailey, "Lucydale" Stud, East Greenmount
	S. Cochrane, "Stanroy" Stud, Felton
	Garrawin Stud Farm Pty. Ltd., 657 Sandgate road, Clayfield
	G. Handley, "Handleigh" Stud, Murphy's Creek
	J. L. Handley, "Meadow Vale" Stud, Lockyer
	R. G. Koplick, "Melan Terez" Stud, Rochedale
	H. V. Littleton, "Wongalea" Stud, Crow's Nest
	O'Brien and Hickey, "Kildurham" Stud, Jandowae East
	E. Pukallus, "Plainby" Stud, Crow's Nest
	G. C. Traves, "Wynwood" Stud, Oakey
	E. Tumbridge, "Bidwell" Stud, Oakey
	Westbrook Farm Home for Boys, Westbrook
	H. W. Wyatte, Rocky Creek, Yarraman
	H.M. State Farm, "Palen Creek," Palen Creek
	A. R. Ludwig and Sons, "Cryna" Stud, Beaudesert
	H. H. Sellars, "Tabooba" Stud, Beaudesert
	F. Thomas, "Rosevale" Stud, Beaudesert
	Bowkett and Meacle, "Myola Vale" Stud Piggery, Burra Burri, Jandowae
	D. T. Law, Trouts Road, Aspley
	R. J. McCullough, "Maxholm" Berkshire Stud, Gatton
	C. F. W. and B. A. Schellback, "Redvilla" Stud, Kingaroy
	R. H. Crawley, "Rockthorpe" Stud, via Pittsworth
	F. R. J. Cook, "Alstonvilla," Woolvi, via Gympie
	J. H. N. Stoodley, "Stoodville," Ormiston
Large White	H. J. Franke and Sons, "Delvue" Stud, Cawdor
	Garrawin Stud Farm Pty. Ltd., 657 Sandgate road, Clayfield
	F. L. Hayward, "Curyo," Jandowae
	J. A. Heading, "Highfields," Murgon
	K. B. Jones, "Cefn" Stud, Pilton
	R. G. Koplick, "Melan Terez" Stud, Rochedale
	R. Postle, "Yarralla" Stud, Pittsworth
	E. C. Smith, "Smithfield" Stud, Coomera
	E. J. Bell, "Dorne" Stud, Chinchilla
	A. G. Fry, "Birubi" Stud, Dalby
	N. E. Meyers, Halpine Plantation, Kallangur
	L. C. Lobegeiger, "Bremer Valley" Stud, Moorang, via Rosewood
	J. H. G. Blakeney, "Talgai" Stud, Clifton
	V. P. McGoldrick, "Fairymeadow" Stud, Cooroy
	N. Woltmann and Sons, Wooroolin
	R. S. Powell, Kybong, via Gympie
	E. B. Horne, "Kalringal," Wooroolin

TESTED HERDS—continued.

Breed.	Owners Name and Address of Stud.
Tamworth	A. A. Herbst, Bahr Scrub, via Beenleigh
	S. Kanowski, " Miecho " Stud, Pinelands
	N. R. Potter, " Actonvale " Stud, Wellcamp
	D. F. L. Skerman, " Waverley " Stud, Kaimkillenbun
	A. C. Fletcher, " Myola " Stud, Jimbour
	L. C. Lobegeiger, " Bremer Valley " Stud, Moorang, via Rosewood
	Salvation Army Home for Boys, Riverview
	F. Thomas, " Rosevale " Stud, Beaudesert
	A. J. Surman, Noble Road, Goodna
	P. V. McKewin, "Wattleglen" Stud, Goombungee
	Department of Agriculture and Stock, Regional Experiment Station, Kairi
	P. V. Campbell, Lawn Hill, Lamington
Wessex Saddleback ..	W. S. Douglas, " Greylight " Stud, Goombungee
	K. Day and P. Hunting, " Kazan " Stud, Goodna
	E. Sirrett, " Iona Vale " Stud, Kuraby
	C. R. Smith, " Belton Park " Stud, Nara
	H. H. Sellars, " Tabooba " Stud, Beaudesert
	H. Thomas, " Eurara " Stud, Beaudesert
	D. T. Law, Trouts Road, Aspley
	G. J. Wilson, " Glenbella " Stud, Silverleigh
	G. J. Cooper, "Cedar Glen", Yarraman
	J. B. Dunlop, Acacia Road, Kuraby

Dairying and Banana-growing Country on the South Coast.

A Survey of Dairy Herd Wastage in Queensland for the Years 1948-51.

C. H. CLARK, Dairy Officer, Herd Recording

A SURVEY of dairy herd wastage was completed in 1947-48 and information was prepared and published by S. E. Pegg and E. B. Rice in the *Queensland Agricultural Journal* for December, 1949. The survey was based on information received from 122 farmers throughout the State. Similar surveys were carried out in 1948-49, 1949-50 and 1950-51, and data available from these surveys were used to provide the information included in this article.

SOURCES OF DATA.

The requisite information used in compiling this survey was furnished by farmers in various parts of the State who co-operated by forwarding monthly returns containing particulars of their herds and herd wastage. The survey was made from July, 1948, to June, 1951, and the number of farmers forwarding monthly returns for the various years was 64 in 1948-49, 66 in 1949-50, and 73 in 1950-51. In the three years, complete returns were received for 203 herds and this survey has been carried out on these herds. The data may be considered as 203 "herd years," as the seasons in which the survey was completed were fairly uniform. Figures supplied by the Meteorological Bureau, Brisbane, show that rainfall in all areas covered by the survey was above normal for most months of the three years, except in the latter part of 1948 and May and June, 1951. Table 1 gives rainfall data for districts included in the survey.

TABLE 1.

AVERAGE RAINFALL (INCHES) FOR THE YEARS 1948, 1949 AND 1950 IN DISTRICTS INCLUDED IN THE SURVEY.

Year.	District.				
	North Coast (Barron).	South Coast (Port Curtis).	South Coast (Moreton).	Darling Downs (East).	Darling Downs (West).
1948	53·33	31·38	45·15	27·32	20·53
1949	75·69	43·17	51·21	30·60	20·11
1950	92·80	55·31	69·75	41·08	34·46
Normal Annual Rainfall . .	67·29	37·36	47·70	27·86	21·91

DISTRIBUTION OF HERDS.

The distribution of herds according to districts was:—North Queensland (Atherton Tableland and Daintree) 29 (14·3 per cent.); Central Queensland (Rockhampton, Gladstone and Callide Valley) 11 (5·4 per cent.); Central and Upper Burnett (Biggenden, Gayndah and Monto) 9 (4·4 per cent.); South Burnett (Nanango, Kingaroy, Murgon and Goomeri) 66 (32·5 per cent.); South-eastern Queensland (Theebine to the New South Wales border and inland to the Dividing Range) 73 (36·0 per cent.); Darling Downs 15 (7·4 per cent.).

The size of herds included in the survey was very variable and Tables 2 and 3 show that herds of all sizes are represented in the various districts throughout the whole period 1948-51.

TABLE 2.

SIZES OF HERDS IN SURVEY.

Year.	Herd Size.						
	1–50.	51–75.	76–100.	101–125.	126–150.	Over 150.	Totals.
1948–49	7	22	18	7	6	4	64
1949–50	11	28	14	9	3	1	66
1950–51	14	26	14	11	7	1	73
Totals ..	32	76	46	27	16	6	203
Per Cent. ..	15·8	37·4	22·7	13·3	7·9	3·0	..

TABLE 3.

HERD SIZE IN VARIOUS DISTRICTS.

District.	Herd Size.						
	1–50.	51–75.	76–100.	101–125.	126–150.	Over 150.	Totals.
North Queensland	3	10	5	8	3	..	29
Central Queensland	..	5	4	..	1	1	11
Upper and Central Burnett ..	..	4	2	1	1	1	9
South Burnett ..	17	29	12	5	3	..	66
South-Eastern Queensland ..	10	24	21	11	6	1	73
Downs	2	4	2	2	2	3	15
Totals ..	32	76	46	27	16	6	203

Tables 4 and 5 indicate the area of farms included in the survey. It is seen that 39 (or 19·2 per cent.) of the farms surveyed were over 500 acres. Many of the farms on the Darling Downs were situated in the Western Downs area, where mixed farming is general. The chief breeds of cattle on the 203 farms are shown in Tables 6 and 7. All breeds were represented except Ayrshire. The chief breeds of dairy cattle in Queensland are A.I.S. and Jersey and these were well represented in all districts for the various years.

TABLE 4.

SIZE OF FARMS INCLUDED IN THE SURVEY.

Year.	Acreage. 1–50.	51–100.	101–150.	151–200.	201–250.	251–300	301–350.	351–400.	401–450.	451–500.	501–1,000.	Over 1,000.	Totals.
1948–49	..	2	4	10	7	9	7	5	6	1	11	2	64
1949–50	..	2	3	18	9	5	4	4	2	7	9	3	66
1950–51	3	6	7	13	9	3	8	2	4	4	9	5	73
For 3 years, 1948–51 ..	3	10	14	41	25	17	19	11	12	12	29	10	203

TABLE 5.

SIZE OF FARMS IN THE SURVEY ACCORDING TO DISTRICTS.

District.	Acreage. 1–50.	51–100.	101–150.	151–200.	201–250.	251–300	301–350.	351–400.	401–450.	451–500.	501–1,000.	Over 1,000.	Totals.
North Queensland ..	..	1	5	5	5	5	1	2	4	1	..	..	29
Central Queensland ..	..	..	..	..	..	1	1	1	2	1	4	1	11
Upper and Central Burnett	..	..	..	..	..	2	1	1	1	..	3	1	9
South Burnett.. ..	..	..	4	7	13	1	11	4	3	9	11	3	66
South-Eastern Queensland	3	9	4	29	6	8	4	3	1	1	5	..	73
Downs	..	..	1	..	1	..	1	..	1	..	6	5	15
Totals	3	10	14	41	25	17	19	11	12	12	29	10	203

TABLE 6.

BREEDS OF HERDS IN SURVEY.

Breed.	1948–49.	1949–50.	1950–51.	For 3 years, 1948–51.	Per Cent.
A.I.S.	31	34	28	93	45·8
Jersey	23	22	38	83	40·9
Guernsey	1	1	2	4	2·0
Friesian	1	2	1	4	2·0
Jersey x A.I.S. cross	2	5	1	8	4·0
Mixed	6	2	3	11	5·4
Totals	64	66	73	203	..

TABLE 7.

BREEDS OF HERDS IN SURVEY ACCORDING TO DISTRICT.

Breed.	North Queensland.	Central Queensland.	Upper and Central Burnett.	South Burnett.	South-Eastern Queensland	Downs.	Total.
A.I.S.	10	6	5	47	17	8	93
Jersey	14	5	2	12	43	7	83
Guernsey	1	..	1	1	1	..	4
Friesian	..	..	..	..	4	..	4
Jersey x A.I.S. cross	2	..	..	2	4	..	8
Mixed	2	..	1	4	4	..	11
Totals	29	11	9	66	73	15	203

HERD WASTAGE.

The analysis in this survey of wastage or loss due to low production, disease and other factors which affect the economic usefulness of the animal or its productive life has provided valuable information to supplement the preliminary survey of 1947-48. Both surveys show that the chief reasons for disposals from dairy herds in Queensland follow the same pattern as that revealed by New South Wales and New Zealand investigations. The chief reasons for disposals in Queensland are in the following order of importance:—

(1) Sales of surplus stock for dairy purposes.

(2) Low production.

(3) Old age.

(4) Udder troubles, chiefly mastitis.

(5) Failure to breed (that is, sterility due to various causes).

TABLE 8.

TOTAL WASTAGE OF HERDS INCLUDED IN THE SURVEY.

——	1948–49.	1949–50.	1950–51.	Average for 3 years, 1948–51.*
	Per Cent.	Per Cent.	Per Cent.	Per Cent.
Wastage including cattle sold for dairy purposes	24·8	15·5	15·1	18·5 (19·6)
Wastage excluding cattle sold for dairy purposes	16·8	12·8	12·4	14·0 (13·1)

* Figures from the 1947-48 survey are given in parenthesis for comparison.

TABLE 9.

TOTAL WASTAGE IN HERDS ACCORDING TO DISTRICT.*

——	North Queensland.	Central Queensland.	Upper and Central Burnett.
	Per Cent.	Per Cent.	Per Cent.
Wastage including cattle sold for dairy purposes	20·1 (24·9)	25·1 (22·1)	30·4 (22·3)
Wastage excluding cattle sold for dairy purposes	11·6 (14·4)	22·4 (16·5)	21·2 (12·9)
——	South Burnett.	South-Eastern Queensland.	Downs.
	Per Cent.	Per Cent.	Per Cent.
Wastage including cattle sold for dairy purposes	14·2 (9·5)	17·4 (18·1)	21·4 (17·9)
Wastage excluding cattle sold for dairy purposes	12·3 (8·1)	13·6 (14·5)	15·8 (10·1)

* Figures for 1947-48 survey are given in parenthesis for comparison.

The total wastage of stock in herds included in this survey is set out in Tables 8 and 9. Cattle sold for dairy purposes constitute a large percentage of disposals, but as they are not lost to the industry they cannot be included in determining true wastage. It is evident that a large number of cattle were sold for dairy purposes in 1948-49, chiefly in the Central Queensland and Upper and Central Burnett districts. This explains the large percentage wastage, including cattle sold for dairy purposes, in that year as shown in the tables. Excluding cattle sold for dairy purposes, the true wastage for the State over the three-year period was 14·0 per cent., which means that the average life of a dairy cow in Queensland is 7·1 years, or the average dairy cow completes barely five lactation periods.

In collecting information for the compilation of this survey the ages of animals were not included and therefore it was impossible to assess the average age of disposal or to analyse wastage according to age. As a check on the final wastage in dairy herds, figures from statistical sources may be used. Figures made available by the Queensland Government Statistician are given in Table 10 and show that the percentage of heifers available for replacement (18·9 per cent.) is greater than percentage wastage in Tables 8 and 9. Allowances cannot be made for heifers which do not produce a calf, as no information is available on this aspect at present.

TABLE 10.

HEIFERS IN DAIRY HERDS IN QUEENSLAND.

Year.	No. of Heifers (1 year and over).	Percentage of Total Herds.
1948	213,451	18·3
1949	225,756	18·8
1950	234,317	19·5
For 3 years 1948–50	673,524	18·9

In order to assess the various causes of wastage, Tables 11 and 12 have been compiled. Table 11 shows the various causes of wastage and their order of importance for the three years of the survey, while Table 12 confirms that results for the State are typical of the chief dairying districts. Table 11 reveals that culling for low production has increased from 19.7 per cent. in 1948-49 to 39.3 per cent. in 1950-51. As many herds surveyed have been production recorded for various periods it is obvious that herd recording is responsible for a heavier culling rate for low production than obtains in the majority of non-recording herds.

Reference to the tables indicates that udder troubles have decreased fairly rapidly in the three years, as they constituted 10.4 per cent. of wastage in 1948-49 and only 5.3 per cent. in 1950-51. This is probably due to the increased use of the strip cup resulting in the earlier detection of mastitis and in the extensive use of penicillin in treating the disease.

Old age, sterility and calving troubles are important causes of wastage in each year of the survey. The incidence of accidents is notable in all districts and for each year of the survey. A large number of fat cows and calves a few months old were sold for slaughter in the Central Queensland and Central and Upper Burnett areas especially in 1948-49.

TABLE 11.

VARIOUS CAUSES OF WASTAGE SHOWN AS PERCENTAGES OF TOTAL WASTAGE, EXCLUDING CATTLE SOLD FOR DAIRY PURPOSES.

Causes.	1948–49.	1949–50.	1950–51.	Average for 3 years, 1948–51.†
Low production	19·7	31·0	39·3	29·1 (17)
Aged	18·6	18·8	10·9	16·2 (24)
Udder troubles	10·4	5·8	5·3	7·5 (18)
Brucellosis	·5	·2	1·2	·7 (7)
Sterility	4·8	3·8	4·9	4·6 (4)
Calving troubles	2·6	3·3	2·7	2·8 (3)
Tuberculosis	1·7	1·1	·1	1·0 (2)
Poisoning	·4	3·9	1·8	1·8
Bloat	1·3	·2	·1	·6
Tick fever	..	1·1	..	·3 (2)
Milk fever	·3	·2	..	·2
Accidents	5·3	6·4	7·8	6·4 (4)
Killed by dingoes	·9	·3	·4	·6 (1)
Blackleg	·2	2·5	1·2	1·2
Scours	·9	·9	..	·6
*Sold for slaughter	20·2	3·9	8·6	12·0
Other known causes	2·6	2·4	3·1	2·7 (10)
Unknown	9·6	14·3	12·5	11·8 (8)

* Sold for Slaughter includes fat cows, and calves reared for various periods and then sold as vealers.

† Figures from the 1947-48 survey are given in parenthesis for comparison.

An attempt was made to determine wastage according to herd size and this information is found in Table 13. While the number of herds is too small to give any conclusive indication of the effect of herd size on wastage, there appears to be lowest incidence of wastage in the smallest herd-size groups.

TABLE 12.

Causes of Wastage in Various Districts shown as Percentages of Total Wastage, excluding Cattle Sold for Dairy Purposes.

Causes.	North Queensland.	Central Queensland.	Upper and Central Burnett.	South Burnett.	South-Eastern Queensland.	Downs.
Low production ..	28·9	28·4	10·6	35·8	32·0	18·7
Aged	17·1	14·9	33·9	15·7	13·4	14·1
Udder troubles ..	5·6	1·8	2·8	9·6	8·5	10·4
Brucellosis	..	..	1·7	1·7	·4	..
Sterility	8·7	3·6	2·2	3·9	4·8	2·9
Calving troubles ..	2·4	·9	1·1	5·5	1·8	3·7
Tuberculosis	1·4	6·8	..	·9	..	..
Poisoning	3·1	..	·6	·9	3·1	·4
Bloat	..	2·3	·6	·4	·2	1·7
Tick fever	..	..	..	·6	·5	..
Milk fever	..	..	·6	·2	..	·8
Accidents	6·3	3·2	7·2	4·6	8·9	4·1
Killed by dingoes ..	..	1·4	1·7	·9	·2	..
Blackleg	..	..	..	1·7	2·0	·4
Scours	·3	1·8	1·1	..	·4	1·7
*Sold for slaughter ..	1·0	32·0	28·9	6·6	5·4	28·6
Other known causes	11·8	..	1·1	·6	2·4	1·2
Unknown	13·2	3·2	6·1	10·5	15·9	11·2

* Sold for Slaughter includes fat cows, and calves reared for various periods and then sold as vealers.

TABLE 13.

Wastage according to Herd Size.

Herd Size.	Total Herds.	Wastage including Cattle Sold for Dairy Purposes.	Wastage excluding Cattle Sold for Dairy Purposes.
		Per Cent.	Per Cent.
1–50	32	14·1	11·4
51–75	76	19·6	15·4
76–100	46	15·8	12·8
101–125	27	19·6	14·9
126–150	16	20·3	13·2
Over 150	6	22·9	15·5
Total	203	..	..
Wastage (all herds)	..	18·5	14·0

COWS AND HEIFERS PER BULL.

Table 14 indicates the average number of cows and heifers per bull. It may be noted that the figures are similar to those of the 1947-48 survey except for the Central and Upper Burnett districts. No satisfactory explanation is available as to why these figures are so dissimilar.

Particulars of calves not reared are included in Tables 18 and 19. The percentage of calves slaughtered is high in the South-eastern Queensland area. This may be accounted for by the fact that 60 per cent. of herds surveyed in this area were Jersey herds. The number of calves which died soon after birth is highest on the Downs. This was also shown in 1947-48 survey data.

TABLE 14.

NUMBER OF COWS AND HEIFERS PER BULL.*

District.	Average.
All Queensland	34 (40)
North Queensland	30 (29)
Central Queensland	42 (40)
Upper and Central Burnett	27 (46)
South Burnett	35 (40)
South-Eastern Queensland	35 (40)
Downs	38 (38)

* Figures from 1947-48 survey given in parenthesis for comparison.

STOCK CARRYING CAPACITY OF FARMS.

In assessing the stock carrying capacity of the 203 farms under survey, the same procedure was followed as in the 1947-48 survey—that is, no allowance was made for any portion of the farm used for cultivation of cash crops or other purposes than dairy cattle, which is quite appreciable in most dairying districts in Queensland where dairying is so frequently associated with mixed farming. This is evident from Table 15, where acres per head in the South Burnett district range from 2.5 to 20.0 and those in the Darling Downs area from 3.6 to 41.7. The figure of 13.0 acres per head for the Darling Downs district reflects the majority of farms in the Western Downs area where mixed farming is practised largely.

TABLE 15.

ACRES PER HEAD OF DAIRY CATTLE.*

District.	Average.	Range.
All Queensland	4·9 (5·3)	1·0—41·7
North Queensland	3·0 (2·5)	1·3— 5·3
Central Queensland	6·3 (6·9)	3·4— 8·7
Upper and Central Burnett	6·0 (7·0)	2·9—11·6
South Burnett	5·8 (4·4)	2·5—20·0
South-Eastern Queensland	2·7 (2·9)	1·0— 6·9
Downs	13·0 (6·6)	3·6—41·7

* Figures for 1947-48 survey given in parenthesis for comparison.

CALF WASTAGE.

Tables 16 and 17 indicate the percentages of male and female calves born and the percentages of calves reared. Perusal of the tables shows that there is a considerable variation in the number of calves reared in the various districts of the State, and there is also a variation in the numbers reared in each of the three years. It should be noted that in the Central Queensland, Upper and Central Burnett and Downs areas a large percentage of calves are reared, but referring to Table 12 it is evident that many of these calves are later sold as vealers and constitute a high percentage of total herd wastage. The average percentage of heifers reared for the state is 63.3 and therefore ample calves are being reared for normal herd replacements.

TABLE 16.

Sex of Calves and Percentages of Calves Reared.

—	1948–49.	1949–50.	1950–51.	Average for 3 years, 1948–51.*
Heifers born	47·0	44·1	45·5	45·6 (48·1)
Bulls born	53·0	55·9	54·5	54·4 (51·9)
Heifers reared	68·9	58·7	61·3	63·3 (70·5)
Bulls reared	13·5	7·7	12·4	11·4 (26·2)

* Figures for 1947-48 survey given in parenthesis for comparison.

TABLE 17.

Sex of Calves and Percentages of Calves Reared in Various Districts.

—	North Queensland.	Central Queensland.	Upper and Central Burnett.	South Burnett.	South-Eastern Queensland.	Downs.
Heifers born ..	45·1	47·5	47·3	46·4	44·7	45·2
Bulls born ..	54·9	52·5	52·7	53·6	55·3	54·8
Heifers reared	64·1	80·0	91·5	48·2	63·4	90·1
Bulls reared ..	7·1	13·1	21·8	5·1	7·7	52·2

TABLE 18.

Disposal of Calves not Reared as Percentages of all Calves Born.

—	1948–49.	1949–50.	1950–51.	Average for 3 years, 1948–51.*
Sold	27·5	42·8	26·6	31·6 (32·0)
Slaughtered	29·8	24·3	36·3	30·6 (23·0)
Died	2·3	2·2	2·1	2·2 (1·5)
Stillborn	·7	·4	·4	·5 (·6)
Killed by dingoes	·1	·04	·03	·07 (–)

* Figures for 1947-48 survey given in parenthesis for comparison.

TABLE 19.

Disposal of Calves not Reared in Various Districts shown as Percentages of All Calves Born (Various Districts, 1948–51).

—	North Queensland.	Central Queensland.	Upper and Central Burnett.	South Burnett.	South-Eastern Queensland.	Downs.
Sold	33·5	19·4	28·0	61·1	13·5	10·6
Slaughtered ..	31·2	32·9	16·3	10·2	52·2	14·9
Died	2·1	2·7	1·0	2·6	1·4	4·6
Stillborn ..	·4	·5	..	·9	·3	·6
Killed by dingoes ..	..	·5	..	·07	·03	..

DISCUSSION.

The interpretation of these tables on wastage in dairy herds must be restricted to general lines. It must be emphasised that though the data relate to herd wastage based on a fairly representative cross section of the dairy industry, they can be interpreted only as an indication of what is occurring on individual farms. Some farmers may have far more trouble with sterility than with udder troubles and so on. Nevertheless the general position in the industry clearly shows that low production is still the chief item in the average farmer's culling programme. Disease—udder troubles and sterility—account for a large

percentage of wastage and every effort must be made to diagnose, treat or apply preventive measures to decrease the incidence as much as possible. Serious economic losses must result if cows have to be culled before reaching full production, as the economic cow is one which will produce large quantities of milk and butterfat annually and for a number of years. Wastage surveys give useful information which indicates the degree to which various methods of management, feeding and other factors exert an influence on the productive life of dairy cattle and also aid in formulating control measures.

TUBERCULOSIS-FREE CATTLE HERDS.
(AS AT 21st JANUARY, 1952.)

Breed.	Owner's Name and Address of Stud.
Aberdeen Angus	The Scottish Australian Company Ltd., Texas Station, Texas F. H. Hutton, "Bingegang," Dingo
A.I.S.	F. B. Sullivan, "Fermanagh," Pittsworth D. Sullivan, "Bantry" Stud, Rossvale, *via* Pittsworth W. Henschell, "Yarranvale," Yarranlea Con. O'Sullivan, "Navillus Stud," Greenmount H. V. Littleton, "Wongalea Stud," Hillview, Crow's Nest J. Phillips and Sons, "Sunny View," Kingaroy Sullivan Bros., "Valera" Stud, Pittsworth Reushle Bros., "Reubydale" Stud, Ravensbourne H. F. Marquardt, "Chelmer," Wondai W. G. Marquardt, "Springlands," Wondai A. C. and C. R. Marquardt, "Cedar Valley," Wondai A. H. Sokoll, "Chelmsford," Wondai
Ayrshire	L. Holmes, "Benbecula," Yarranlea J. N. Scott, "Auchen Eden," Camp Mountain "St. Christopher's and Iona" Studs, Brookfield Road, Brisbane E. Mathie and Son, "Ainslie" Ayrshire Stud, Maleny
Friesian	C. H. Naumann, "Yarrabine Stud," Yarraman J. F. Dudley, "Pasadena," Maleny
Guernsey	C. D. Holmes, "Springview," Yarraman
Jersey	W. E. O. Meier, "Kingsford Stud," Rosevale, *via* Rosewood J. S. McCarthy, "Glen Erin Jersey Stud," Greenmount J. F. Lau, "Rosallen Jersey Stud," Goombungee G. Harley, Hopewell, Childers Toowoomba Mental Hospital, Willowburn Farm Home for Boys, Westbrook F. J. Cox and Sons, "Rosel" Stud, Crawford, Kingaroy Line R. J. Browne, Hill 60, Yangan P. J. L. Bygrave, "The Craigan Farm," Aspley A. Verrall and Sons, "Coleburn Stud," Walloon R. J. Crawford, "Inverlaw Jersey Stud," Inverlaw, Kingaroy P. H. F. Gregory, "Carlton," Rosevale, via Rosewood E. A. Matthews, "Yarradale," Yarraman A. L. Semgreen, "Tecoma," Coolabunia G. & V. Beattie, "Beauvern," Antigua, Maryborough L. E. Meier, "Ardath" Stud, Boonah A. M. and L. J. Noone, "Winbirra" Stud, Mt. Esk Pocket, Esk

Pumpkins, Squashes and Marrows, and Grammas.

PREPARED BY OFFICERS OF THE AGRICULTURE BRANCH.

PUMPKINS, squashes, marrows and grammas all belong to the one botanical family known as Cucurbitaceae, and individual members of the family are often referred to as cucurbits. Other well known plants within this family are cucumber, gherkin, rockmelon, watermelon, and choko, but these are mainly horticultural crops and will not be dealt with in this article. The family also includes a number of gourds, the fruit of which are used for ornamental purposes, for water carrying or for providing "vegetable sponges."

As with many cultivated plants, the origins of the pumpkin group are somewhat obscure. It seems certain, however, that the pumpkins, as we know them, originated in the tropics of South America, and the squashes and marrows in the regions near Asia Minor. Both Chinese and Central American origins have been ascribed to the grammas. The pumpkins and grammas are essentially tropical plants and are extensively grown in all the warmer countries of the world. The more rapidly maturing squashes and marrows are, however, capable of being grown during the shorter summers of more temperate regions; their cultivation thus extends to the northern countries of Europe and also into southern Canada.

The plants of this group are typically vigorous, fleshy, prostrate annuals with a strongly running or vining habit, with branched tendrils, and with large fleshy fruits with a hollow centre. Individual flowers are either male or female (never both). However, both male flowers and female flowers are normally found on all plants. As pollination is effected by insects, ample opportunities for cross-pollination between neighbouring plants or neighbouring varieties exist.

The fruits of this group are used primarily for culinary purposes and for stock food. Culinary uses include boiling or baking the flesh (as a vegetable with meats), flavouring for scones and pastry, filling for pastry, and a jam base. The demand for these vegetables (particularly pumpkin) varies considerably, being bound up to some extent with the availability or otherwise of potatoes. The demand is usually constant in large establishments, on account of the relative simplicity of preparation. Both culinary and specific stock varieties are fed to farm animals, of which pigs are the principal consumers.

Plate 70.
An Irrigated Crop of Queensland Blue Pumpkins in the Lockyer Valley. The effects of good cultivation are evident in the freedom from weeds.

In Queensland agriculture this group of plants is dominated by the pumpkins, which have long been recognised as one of the State's major summer crops (Plate 70). They are grown very largely for farm use as well as for market, both local and interstate. The grammas are grown mostly on a small scale for farm and home consumption, while the marrows and squashes are profitable market crops but mainly for the small farmer and market gardener. A total area of some 25,000 to 30,000 acres is devoted annually to these crops, with a return of some 60,000 to 75,000 tons of produce. During the latter years of the Second World War the annual Queensland acreage exceeded 40,000, for a yield of almost 100,000 tons.

CLASSIFICATION.

There is always a great deal of confusion in the classification and naming of plants of this group. This confusion is particularly evident in the use of the terms "pumpkin" and "squash." In the United States of America, for example, many of the varieties which we would class as "pumpkins" are generally referred to as "squashes;" conversely, a number of our Australian "squashes" are there classed as "pumpkins." A typical example of this confused nomenclature is afforded by the Hubbard variety. This variety originated in America as the Hubbard "squash" and has been introduced to Australia under that name. This variety, however, belongs to the same botanical species as our common "pumpkins" (for example, Queensland Blue, Crown and Triamble) and should therefore be referred to in Australia as the Hubbard "pumpkin."

The genus *Cucurbita*, to which all this group belong, is divided by botanists into three important commercial species:—*Cucurbita maxima*, *C. pepo* and *C. moschata*. The first species comprises all the varieties of pumpkin as understood in this country. The second species includes the well known vegetable marrows and squashes, while the third covers the grammas, bugles and cushaws. These three species are generally identified without difficulty, either on their general appearance or by such characteristics as leaf shape, nature of stem and fruit stalk, and shape and texture of the fruit (Plate 71).

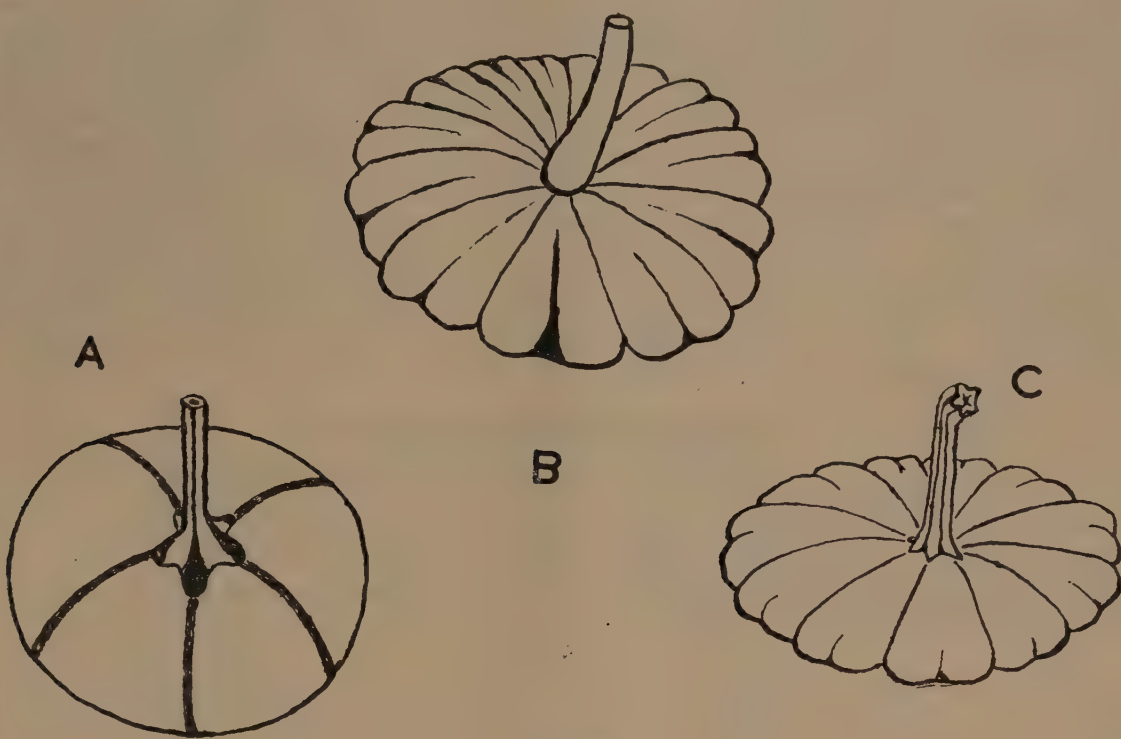

Plate 71.

Method of Attachment of the Fruit Stalk in the Three Cucurbit Species.
A, Cucurbita moschata (grammas); B, Cucurbita maxima (pumpkins); C, Cucurbita pepo (squashes and marrows).

In the pumpkin group (*C. maxima*) the plant is normally a strong runner, and the stems are cylindrical (not ridged or grooved) and covered with harsh hairs. The leaf is rounded or kidney-shaped, and though the edges may be somewhat scalloped they are not deeply lobed. The fruit stalk is round in cross section and is somewhat fleshy at maturity. Fruits are of various shapes but do not include crookneck types such as may be found in the two other species. These fruits are relatively late maturing, and possess hard shells which enable them to be stored for considerable periods, particularly during winter months. The best known classes within this species are the common table pumpkins, the true cattle pumpkins, Hubbard pumpkins and banana pumpkins, all of which possess the characteristic yellow or orange flesh.

The stems of the squashes and marrows (*C. pepo*) are typically five-sided, grooved and spiny (rather than hairy, as in the other two species). The leaves are distinctly lobed, the number of lobes ranging from three to seven. The fruit stalk, like the stem, is distinctly grooved and is hard at maturity; it may be somewhat enlarged where it joins the fruit, but is not markedly flared as is generally the case with *C. moschata* (Plate 71). Squashes and marrows may be of runner or

bush type, the latter being more generally popular in this country. The fruit, which is typically quick maturing, is harvested in an immature condition for best vegetable quality. The group comprises the vegetable marrows, squashes (including the scallops or "patty-pans"), sugar squashes, fordhook squashes and crookneck squashes.

Members of the third species (*C. moschata*) are runners like the pumpkins, but their stems are typically angular rather than round. Stems are hairy like pumpkin, and not spiny like the squashes; stem hairs are, however, often softer than on the pumpkins. Leaves are lobed, but not as markedly as those of the previous group, usually with whitish blotches at the intersections of the veins. The fruit stalk is angular and is generally flared out on all sides where it joins the fruit (Plates 71 and 81). Fruits, which are mainly hard-shelled, store moderately well; some of the smaller forms (for example, the papaw gramma) will store for long periods. This species in general is late maturing, and is probably better suited to the tropics than either of the other groups. It includes all the true grammas (or cushaws as they are called in parts of America) and is the species commonly used for "pumpkin" pies and jams as well as for stock food, but only occasionally as a table vegetable.

CROSS-FERTILIZATION

It has been mentioned previously that cross-pollination is of very frequent occurrence in the cucurbits, on account of their unisexual flowering habit (Plate 72). It should be clearly realised, however, that such crossing cannot take place naturally between different genera or between different species of the one genus.

It is a commonly believed fallacy among farmers that pumpkins should not be grown in close proximity to watermelons, cucumbers, &c., because of the danger of contamination through cross-fertilization. This belief is quite without foundation, as pumpkins are members of a different genus from the watermelons and cucumbers, and could not possibly cross with them by any natural means.

Similarly, the three different species dealt with in this article do not naturally inter-cross under field conditions. There would be no risk of contamination, therefore, in growing a variety of pumpkin alongside a variety of gramma or of squash. It is important to realise, however, that varieties will inter-cross readily *within any one of these species.* If, for example, a variety of table pumpkin and one of cattle pumpkin are grown in close proximity there would be a considerable risk of crossing between the two, with disastrous effects upon the purity of both types. It is for this reason that so many of the cucurbit varieties are highly impure and provide very mixed samples of fruit.

Where a farmer possesses a reasonably uniform strain of any of these crops and wishes to maintain his own seed stocks, he should plant his plot as far as he possibly can from plants of any other variety of that same species. As pointed out previously, it does not matter if a pumpkin variety is grown alongside a gramma, or a squash alongside a watermelon. Where two varieties of the same species are grown closer together than say a half-mile, and seed is required from one or both varieties, then fruits for seed should be selected from the middles of the respective crops or from the sides which are farthest from possible contamination.

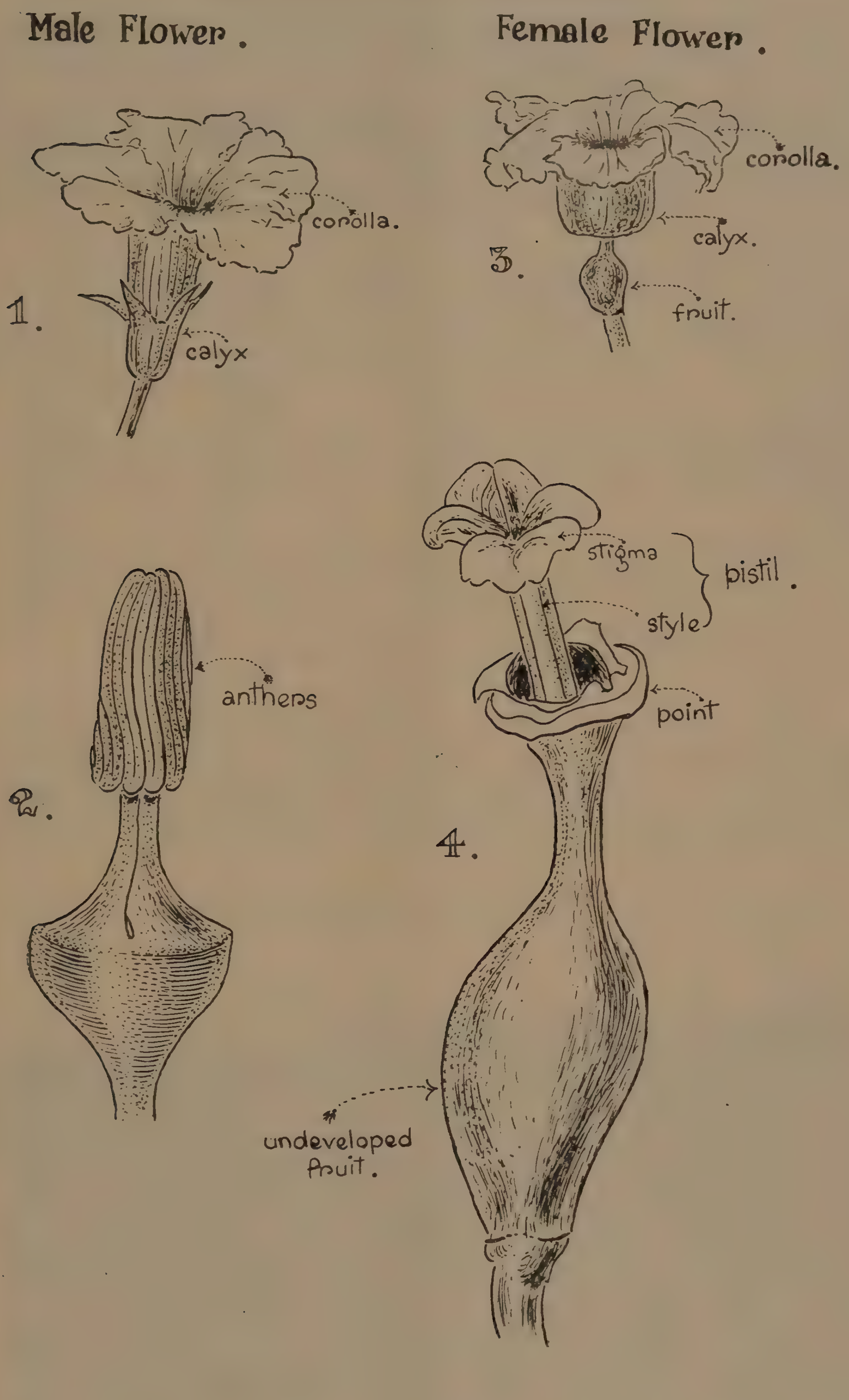

Plate 72.

Flower Types in the Cucurbit Crops. 1 and 2 are male flowers, 3 and 4 female flowers. In 2 and 4 the floral parts have been removed to show the functional organs.

MAIN PRODUCING DISTRICTS.

Pumpkins are successfully grown in all the agricultural districts of Queensland, but at present their production is concentrated in the more densely populated and intensively farmed areas of the south. Table 1 lists the acreage and production of pumpkins for the various statistical divisions of Queensland for the 1949-50 season. These figures are a close parallel to those for the preceding season and give a picture of the State's present production pattern.

TABLE 1.

PUMPKIN PRODUCTION BY DISTRICTS, 1949–50 SEASON.

Division.	Acreage.	Production.	Average Yield.
		(Tons).	(Tons per Acre).
Moreton	19,338	47,149	2·44
Maryborough	4,195	12,400	2·96
Rockhampton	2,252	7,262	3·22
Darling Downs	1,298	3,494	2·69
Townsville	918	1,279	1·39
Cairns	261	528	2·02
Mackay	41	41	1·00
Western Districts	46	68	1·48
Total	28,349	72,221	2·55

Source: Government Statistician—Bul. No. 1 of 1951.

Within the Moreton division, which provides about two-thirds of the State's present crop, the Lockyer Valley is the main producer of table pumpkins. The Beaudesert district (which has given its name to a variety) is also an ideal district for pumpkin growing, and produces considerable crops of both table and cattle pumpkins (Plate 73) as well

Plate 73.

Mammoth Cattle Pumpkins Ready for Harvesting; Innisplain, Beaudesert.

as grammas. The Brisbane and Fassifern Valleys also contribute a considerable quota of mixed pumpkin types, while the Brisbane metropolitan district specialises in table varieties.

The main contributions to the Maryborough division's production come from the South Burnett, Central Burnett and the Mary Valley districts. The latter district grows a considerable tonnage of "cattle" pumpkins, mainly for local consumption as pig feed.

On the Darling Downs the crop is regarded as a relatively minor summer crop because of the lack of irrigation facilities and the existence of less risky summer crops. It is, however, frequently grown in association with maize and is largely used for pig feed. Dry-farmed pumpkins from this district have the reputation of keeping better than the irrigated crops from the Lockyer Valley.

In Central Queensland the pumpkin production is fairly evenly spread over the main agricultural areas—the Callide and Dawson Valleys, the Monto district, and the environs of Rockhampton.

Among the more northerly districts the Bowen delta country (in Townsville division) has been the main producing area in the past. Further development is now occurring, however, on such river systems as the Burdekin and the Herbert, where irrigation water is easily available and where frost-free winters are usually experienced. These conditions enable the crop to be grown out of season with the result that premium market prices can be commanded.

Squashes and marrows are produced mainly in the vicinity of Brisbane and the other larger centres of population. In these districts they are normally treated as horticultural crops, being grown in small, well-fertilized areas with frequent irrigation. Otherwise the production of this group is largely scattered in farm and home gardens and intended mainly for home consumption.

The distribution of grammas follows that of cattle pumpkins in the major mixed-farming districts, but on a somewhat smaller scale. Many crops of so-called mixed cattle pumpkins contain representatives of the gramma group as well as true pumpkins.

(TO BE CONTINUED.)

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Advice on Fertilizing and Other Soil Treatment.

AS part of the services to primary producers, the Department of Agriculture and Stock makes recommendations by which the fertility of the soil can be improved and maintained. In most cases, the information is based on the data accumulated from observations over many years on crop behaviour on particular soil types and on analyses made in the course of soil surveys, experimental trials and from samples previously examined. Soil samples have now been analysed from most of the soil types in the farming districts of Queensland.

Enquiries from farmers on soil treatment should normally be submitted in the first instance to the Adviser in Agriculture or Adviser in Horticulture stationed in the district. In areas where there is no easily accessible advisory officer, a letter of enquiry should be forwarded to the Under Secretary, Department of Agriculture and Stock, Brisbane. The letter should give a brief description of the problem involved, for example, a particular crop may not be growing satisfactorily and there may be no obvious pest or disease present. In such a case, the condition of the crop should be described. Where a farmer desires to grow a crop with which he is not familiar, he should give a general description of the area, and the depth and colour of the soil.

A soil sample should not be sent with the initial enquiry. If a soil analysis is considered necessary by the Department, the farmer will be notified to that effect and supplied with directions on the size of the sample required and the method of taking it.

Appropriate officers are stationed at the following centres:—Cairns, Mareeba, Atherton, Townsville, Ayr, Bowen, Mackay, Rockhampton, Bundaberg, Maryborough, Gayndah, Gympie, Kingaroy, Cooroy, Nambour, Caboolture, Brisbane, Redlands, Beenleigh, Southport, Currumbin, Ipswich, Beaudesert, Boonah, Laidley, Toowoomba, Warwick, Stanthorpe.

Dairying Country on the Lower North Coast.

ASTRONOMICAL DATA FOR QUEENSLAND.

MARCH.

Supplied by W. J. Newell, Hon. Secretary of The Astronomical Society of Queensland.

TIMES OF SUNRISE AND SUNSET.

At Brisbane.			MINUTES LATER THAN BRISBANE AT OTHER PLACES.					
Day.	Rise.	Set.	Place.	Rise.	Set.	Place.	Rise.	Set.
	a.m.	p.m.						
1	5·41	6·20	Cairns	31	27	Longreach ..	36	34
6	5·44	6·15	Charleville	27	27	Quilpie	35	35
11	5·46	6·10	Cloncurry	51	48	Rockhampton ..	10	10
16	5·49	6·04	Cunnamulla ..	29	29	Roma	17	17
21	5·52	5·59	Dirranbandi ..	19	19	Townsville ..	25	23
26	5·54	5·53	Emerald	19	19	Winton	41	38
31	5·57	5·48	Hughenden ..	35	33	Warwick	20	18

TIMES OF MOONRISE AND MOONSET.

At Brisbane.

Day.	Rise.	Set.
	a.m.	p.m.
1	10·23	9·13
2	11·24	9·54
	p.m.	
3	12·23	10·41
4	1·20	11·31
5	2·11	..
		a.m.
6	2·57	12·24
7	3·39	1·20
8	4·15	2·16
9	4·48	3·11
10	5·19	4·06
11	5·47	5·00
12	6·16	5·54
13	6·45	6·49
14	7·17	7·46
15	7·52	8·46
16	8·33	9·48
17	9·21	10·52
18	10·16	11·56
		p.m.
19	11·19	12·59
20	..	1·56
	a.m.	
21	12·26	2·47
22	1·35	3·32
23	2·44	4·11
24	3·51	4·47
25	4·55	5·21
26	5·59	5·54
27	7·02	6·29
28	8·05	7·07
29	9·08	7·47
30	10·09	8·32
31	11.08	9·22

MINUTES LATER THAN BRISBANE (SOUTHERN DISTRICTS).

Charleville 27; Cunnamulla 29; Dirranbandi 19;
Quilpie 35; Roma 17; Warwick 4.

MINUTES LATER THAN BRISBANE (CENTRAL DISTRICTS).

Day.	Emerald.		Longreach.		Rockhampton.		Winton.	
	Rise.	Set.	Rise.	Set.	Rise.	Set.	Rise.	Set.
1	12	28	27	43	2	19	30	51
6	10	30	25	45	0	21	27	54
11	18	22	33	38	9	13	38	43
16	28	12	44	27	19	2	52	30
21	29	11	45	26	20	1	53	29
26	21	16	37	31	12	7	43	36
31	9	30	25	45	0	21	26	54

MINUTES LATER THAN BRISBANE (NORTHERN DISTRICTS).

Day.	Cairns.		Cloncurry.		Hughenden.		Townsville.	
	Rise.	Set.	Rise.	Set.	Rise.	Set.	Rise.	Set.
1	11	49	38	63	23	49	10	41
3	3	55	34	67	18	52	4	45
5	2	56	33	67	17	53	3	46
7	7	52	36	65	20	50	7	44
9	16	45	41	60	26	46	14	37
11	26	35	47	55	32	40	22	30
13	36	24	55	46	40	32	30	21
15	46	14	62	40	47	25	38	14
17	54	5	67	34	51	20	44	6
19	56	2	68	32	52	17	46	3
21	53	7	67	35	50	21	44	8
23	43	18	60	43	45	27	36	17
25	31	30	51	50	35	35	25	25
27	20	41	43	58	28	44	17	35
29	9	51	37	64	21	50	8	43
31	3	56	34	67	18	53	4	46

Phases of the Moon.—First Quarter, 3rd March, 11.43 p.m.; Full Moon, 12th March, 4.14 a.m.; Last Quarter, 19th March, 12.40 p.m.; New Moon, 26th March, 6.12 a.m.

On 21st March, at 2 a.m. Eastern Australian Standard Time, the Sun will cross the equator, and on this day will rise and set at true east and true west, respectively. On the 12th and 25th the Moon will rise and set approximately at true east and true west, respectively.

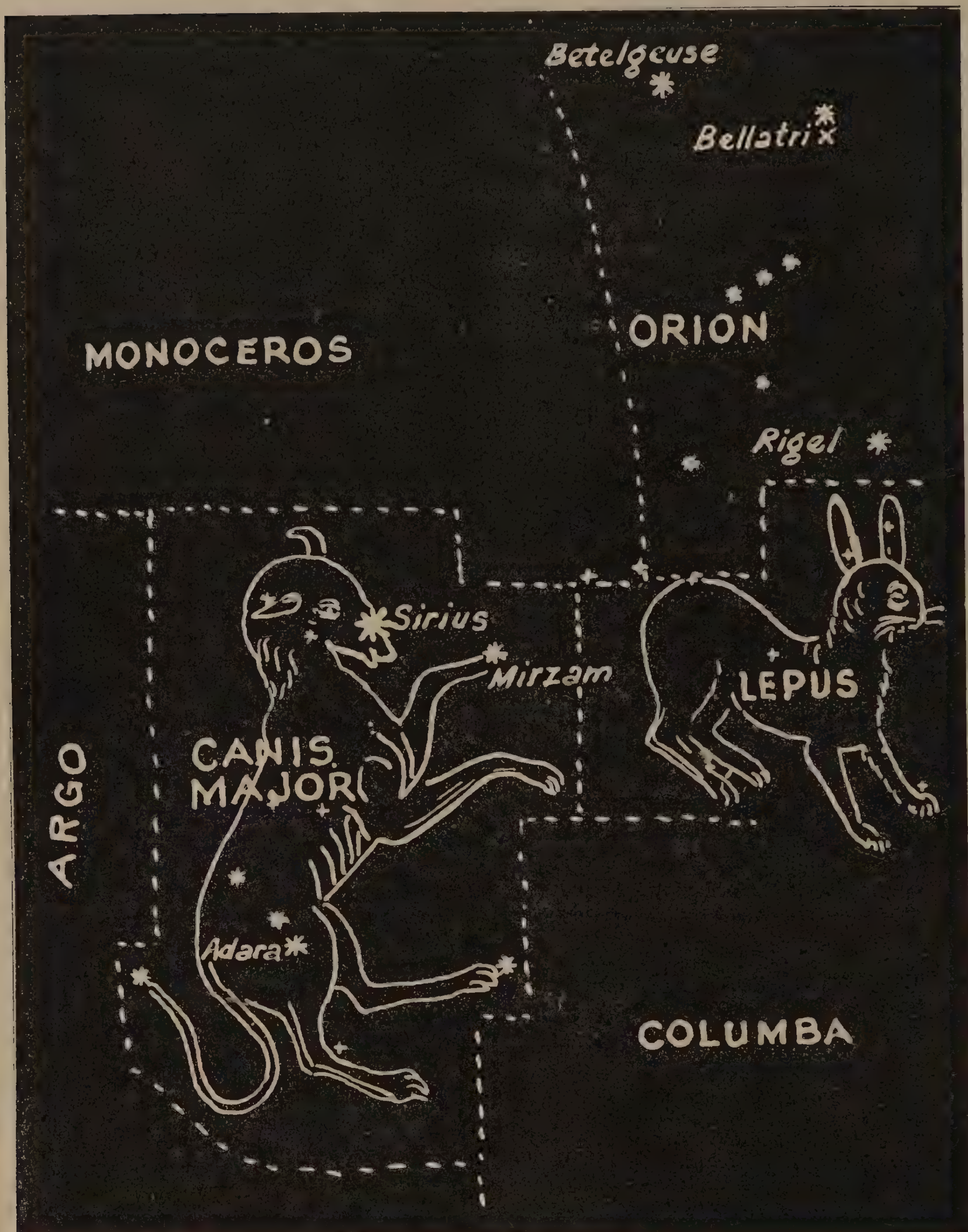
Mercury.—An evening object all this month. On the 1st, in the constellation of Aquarius it will set 24 minutes after the Sun and on the 31st, in the constellation of Pisces, it will set 12 minutes after the Sun. It will be at its greatest angle from the Sun on the 18th, when it will set about 40 minutes after sunset.

Venus.—In the constellation of Capricornus at the beginning of the month it will rise about 2 hours before sunrise and by the end of the month in the constellation of Aquarius it will rise 1 hour 41 minutes before sunrise.

Mars.—In the constellation of Libra, Mars will not show much movement among the stars this month. Up to the 25th it will have an apparent eastward movement, after that date it will move westward. On the 1st it will rise between 9.30 p.m. and 10.45 p.m. and on the 31st it will rise between 7.41 p.m. and 9 p.m.

Jupiter.—Situated in the constellation of Pisces will set 1¾ hours after the Sun at the beginning of March but by the end of the month it will set only ¾ of an hour after the Sun.

Saturn.—At the beginning of the month will rise between 8 p.m. and 9.15 p.m. and by the end of the month will rise at sunset and be visible the whole night.



THE CONSTELLATIONS.

CANIS MAJOR (THE GREAT DOG).

This constellation is said to represent Laelaps, the hound of Actaeon, given to Cephalus by Aurora and placed in the sky because its speed so gratified Jupiter. The group comprises a compact group of brilliant stars bordering the Milky Way. Sirius (Alpha) is the most brilliant star in the heavens and was given its name which means "scorching" or "sparkling" by the Greeks because they attributed the scorching heat of summer to the fact that Sirius rose with the Sun at that period. Known to all navigators as the "Dog Star" Sirius is one of the most interesting binaries in the sky. About 1844 Bessell found that it had wavy irregularities in its proper motion and concluded that it must be revolving round the common centre of gravity of itself and an invisible companion, in a period of about 50 years. It was not until 1862, however, that Alvan Clark discovered its white dwarf companion while testing a new 18½-inch telescope. This white dwarf, known as Sirius B, is a remarkable star of 11.3 magnitude (about one ten thousandth as bright as its primary) but with a mass two-fifths as great. Its density is 36,000 times greater than that of our Sun or 50,000 times that of water. Its diameter is only about 26,000 miles but it contains almost as much matter as our Sun. One cubic inch of material of this star would weigh about half a ton on earth. Other white dwarfs have even greater densities. They are extremely hot but are not conspicuous because of their small dimensions. About 5 degrees south of Sirius is M.41, a fine open cluster of bright stars just visible to the naked eye on a dark night. Epsilon, Mu and Nu are also doubles. Beta is known as Mirzam and Epsilon as Adara.

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EXD

DEPARTMENT OF AGRICULTURE

QUEENSLAND AGRICULTURAL JOURNAL

Jersey Cattle on a South Burnett Farm.

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Volume 74 Part 3

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Edited by
C. W. WINDERS, B.Sc.Agr.

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ROMA STREET . . . . BRISBANE

Pumpkins, Squashes and Marrows, and Grammas.

PREPARED BY OFFICERS OF THE AGRICULTURE BRANCH.

[*Continued from page* 121 *of the February Issue.*]

CLIMATIC AND SOIL REQUIREMENTS.

The climatic and soil requirements of these crops are very similar to those of maize. For best results it is necessary that growth should be maintained without repeated or undue checks. This requires an adequate rainfall (or supplementary irrigation) coupled with warm summer day and night temperatures. The cucurbits are tolerant of quite high temperatures, provided they are not accompanied by a shortage of soil moisture. Plants of this group are very susceptible to frost, and winter or early spring crops can only be grown with safety in normally frost-free areas. Such conditions are satisfied in many North Queensland districts and in a few restricted, sheltered locations near the coast in central and southern districts.

A fertile, well drained soil with a loamy structure is the ideal soil for these crops, and this is the dominant soil type on which they are grown in the main producing districts. The better class agricultural soils of the Lockyer, Beaudesert, Darling Downs, Burnett and Mary Valley districts are all very well suited for the growing of cucurbits. In some of the less favoured districts their culture is restricted to the better alluvials, as is also largely true of the previously listed Lockyer, Beaudesert and Mary Valley districts.

Less suitable soil types may be improved sufficiently with intelligent cultivation and adequate manuring to permit the successful growth of this group of crops, particularly where irrigation facilities are available. Generally speaking, sandy or light-textured soils are most responsive to such treatment, but some stiff clays, provided drainage is adequate, are also capable of being made highly productive. Examples of such red and grey clayey soils in a satisfactory state of production can frequently be met with around the metropolitan area of Brisbane. A poorly drained, badly aerated, sour soil should be avoided at all costs as these crops will not tolerate such conditions.

CROP ROTATION AND GREEN MANURING.

The rapidly developing and extensive root system of the cucurbit crops makes necessary a high degree of soil tilth for the achievement of optimum yields. Without such tilth, plant foods, whether already

existing in the soil or added as fertilizers, cannot be utilized to full advantage. Improvement in tilth can be brought about by judicious cultivation allied to a well-planned system of crop rotation. Improvement, other than that achieved by cultivation, can be most effectively brought about in both light and heavy soils by the addition of farmyard manure or the ploughing under of a green manure crop. To most farmers growing the crop on a considerable acreage, the latter alternative is the only practicable one. The introduction into the crop rotation of a periodic leguminous crop for turning under is therefore highly advisable if pumpkins or other cucurbits are to be a feature of the cropping programme.

Some very sound crop rotations are being evolved for the irrigation farms of the Lockyer Valley. While the details of such rotations would vary from farm to farm, a good general basis might be along the following lines: lucerne for four years (or longer profitable life), followed by potatoes (spring crop), cowpeas (summer crop ploughed under), potatoes (spring crop), pumpkins (late summer), fallow, and return to lucerne. Alternatively, the second potato crop could be followed by a late summer green manure crop, then a spring crop of pumpkins and finally lucerne. Such rotations provide for only one crop of pumpkins in some six or more years, but they certainly do give this crop every opportunity for effective development, and enable it to play a useful part in the cropping programme.

Where lucerne is not grown as a major crop, a simple rotation is potatoes (autumn), pumpkins (spring-summer), potatoes (autumn), pumpkins (spring-summer) followed by a green manure crop. Where crops are being grown for stock food and grazing as well as for sale, such a rotation could be modified to include maize, winter cereals, field peas, or even a pasture phase. Wherever a pasture or lucerne phase is not introduced, however, opportunity should be taken to provide a green manure crop at least once every two years. Whatever regular or irregular rotation is finally adopted, it should not include the growing of pumpkins or grammas on the one area for two or more years in succession.

LIMING, FERTILIZING AND MANURING.

Liming is not generally adopted in the districts in which these crops are grown on a field scale. In some of the heavier rainfall coastal districts, however, where soils tend towards an acid reaction, lime would prove of considerable benefit. Where it is suspected that lime might be required, a soil test should be made to determine the rate at which the lime should be applied. Applications of as low as 3 cwt. per acre of air-slaked lime have given increased yields, but much heavier dressings might be required according to the nature of the soil. Lime should be applied a few weeks before sowing, and should be thoroughly incorporated into the soil.

The beneficial effects of farmyard manure have been referred to in the previous section, but its use is generally restricted in this country to small plantings on a market-garden scale. Periodic dressings of five tons or more per acre will benefit almost all types of soil and will prove to be a major factor in maintaining structure and fertility.

The direct use of artificial fertilizers on these crops is not widespread in Queensland. In the inland agricultural districts most of the better cultivated soils are well supplied with the plant foods required, and fertilizing is not therefore warranted if good rotation practices are followed. In the smaller mixed farming and vegetable crop districts, pumpkins, marrows, squashes, etc., are generally grown following a heavily fertilized crop such as potatoes, tomatoes or beans, and their requirements are largely satisfied by the residual effects of the earlier applications. Where the cucurbits are grown in coastal districts and do not follow a heavily fertilized crop, it may then be advisable to apply a few hundredweights per acre of a complete fertilizer just prior to planting, and possibly to side-dress the young plants with a nitrogen-rich fertilizer. On the small-crop farms surrounding Brisbane, for example, it is customary to use dressings of up to 8 or 10 cwt. per acre of a complete mixture approximating to 5:13:5 composition before planting, and to topdress with 2 oz. per vine of 10:8:7·5 mixture when the plants have run to 12 or 18 inches.

PREPARATION OF THE SEED-BED.

As previously mentioned, these crops have a large and quickly developing root system. This is concentrated mainly in the uppermost 6-12 inches of the soil. Consequently the surface foot of soil should be loose and moist, and due regard should be paid to this requirement when preparing the land for sowing.

The first essential is a deep and thorough ploughing, which should be carried out early in the season and preferably before the June rains. Subsequent requirements in the preparation of the seed-bed will be determined by weather conditions and the farmer's individual experience of what is necessary to bring his particular soil to a high state of tilth. If practicable, the ground should remain open and in a rough condition for a long period through the winter. This will allow frost and other climatic influences to hasten the weathering of the soil, thus rendering large lumps friable. Then, when sufficient rain has fallen to supply adequate subsoil moisture, harrowing should effectively reduce the surface soil to a fairly fine physical condition.

A shallower cross-ploughing, followed by the necessary surface harrowings to break all lumps, should then create the desired tilth. Such a tilth is obtained when the top 1–2 inches of soil is loose and finely divided, and the soil immediately below is moist and firm, but granular and not stiffly compacted. To obtain the desired condition, heavy soils require longer preparation than loams, while sandy soils may need the use of rollers rather than cultivators or harrows in the final stage of preparation.

SOWING.

Sowing periods for the cucurbit crops in Queensland range almost throughout the year, depending largely upon temperature and rainfall conditions in the various producing districts. These plants are all susceptible to frost and must therefore be grown in normally frost-free seasons if they are to be given a reasonable chance of success. Moreover, it has been shown that a minimum soil temperature of approximately 52 deg. F. (or slightly higher than that for maize) is required for seed germination, while the optimum temperature for such germination is around 90 deg. F.

In southern Queensland, planting is generally carried out between August and January. The earlier planting periods are often favoured by farmers as it gives them a chance to get their crops on to a favourable early market. However, for the reasons given above, planting must be delayed until all reasonable danger of frost is over. On certain well protected areas near the coast the frost damage is very slight, enabling these crops to be planted earlier without serious risk.

In most of the coastal districts of North Queensland frost is generally of no significance, with the result that cucurbits can be grown throughout most of the year. In the wetter districts it is important to avoid the heaviest wet-season period, and plantings are generally delayed until April or May. These months are also a favoured planting period for the irrigation districts such as are found in association with the Don, Burdekin and other northern rivers.

It is usual to allow for a sowing rate of about 2 lb. per acre for pumpkins and grammas, and a somewhat heavier rate for the closer spaced marrows and squashes. Table pumpkins are usually sown in drills 10-12 feet apart, seed being dropped singly at distances of 2-4 feet apart, or in hills of 2–3 seeds every 6–8 feet. On some of the more fertile loams the row spacing is increased to 15 feet or more, while on poorer or lighter soils it may be decreased to 7–9 feet. With cattle pumpkins and mammoth types of gramma on good soils, rows are often made 15–20 or more feet apart with 6–12 feet between hills in the row. Squashes and marrows (that is, the table varieties) normally require a row spacing of only 4–5 feet, with two feet between plants in the drill.

Seed is usually dropped by hand into open furrows, and covered to a depth of approximately two inches by scuffler or similar means. In hill sowing, 2–4 seeds may be dropped into a hole made with a hoe, dibble stick or walking-stick planter; if this method is adopted, an ultimate stand of 2–3 plants per hill should be aimed at. In some districts where early seedling losses through insect attack or disease are anticipated, it is customary to plant at much higher rates than those described, and to thin out the seedlings by hoe when the risk of serious mortality has passed.

In districts in which single-row maize planters are available, these may be used with complete satisfaction provided care is taken in selecting the right plate for the seed used. Planting by this means does away with the necessity for exposing open drills to the drying action of sun and wind, and also saves a considerable amount of hand-work. Where large areas are to be planted, or where single-row planters are not available, two-row or four-row planters can easily be used for the job if a little thought is given to the problem. For example, a two-row planter may be used to plant at a row spacing of eight feet, if the machine is set for 4-feet intervals and only one seed hopper is used; such an arrangement would require a 4-feet marker on the side of the empty hopper and a 12-feet marker on the side of the planting hopper. With a four-row planter, a row spacing of 12 feet could easily be obtained by using the two outside hoppers only. Either the press-wheel or the cultivator type of planter would do an excellent job in well prepared seed-beds.

Where machine-planting is adopted, check-row planting has much to recommend it, as it enables subsequent cultivation to be done in two directions at right-angles. Where machines are not equipped for

hill or check-row planting, they should be geared to give a continuous seed drop at a closer spacing than is ultimately required. At a suitable time following germination, the excess seedlings can then be removed by cross-cultivation or hand-hoeing.

In districts of favourable soil and rainfall, pumpkins and grammas are sometimes grown in conjunction with maize. Pumpkin or gramma seed may be substituted for maize in every fourth planting row, or, as is sometimes preferred, a light seeding of the secondary crop is broadcast in amongst the maize just prior to the final inter-row cultivation.

CULTIVATION OF THE CROP.

The main purposes of cultivation are to remove weeds which would compete with the crop for moisture and plant foods, and to keep the surface soil in a condition receptive to further rains. Where the crop is planted in hills on a check-row basis, cultivation can be carried out as required in two directions, thus enabling weeds to be most effectively controlled.

Under favourable conditions the lateral root growth of these crops is quite rapid, and the aim of cultivation should be to keep the surface soil well stirred just ahead of the roots without injuring the latter in any way. Inter-row cultivation may be continued, in successively decreasing bands, until the growth of the vines prevents the further use of implements.

Diamond harrows may be used in the early stages for breaking the surface and destroying young weeds following rain. Where rows are too closely spaced to allow the use of this implement, or where the cultivation space has been decreased by spread of the vines, spring-tine or rigid-tine cultivators are most effectively used. Where weeds have got out of hand during a prolonged wet spell, disc implements may have to be employed, and hand-hoeing near the base of the plants may also be necessary. The ordinary single-row scuffler will probably be the most effective implement for the final cultivations of the crop.

IRRIGATION.

While a considerable proportion of the Lockyer Valley's pumpkin crop is irrigated, the pumpkins and grammas are not generally irrigated elsewhere in the agricultural districts of southern Queensland. Supplementary irrigation is sometimes applied, particularly to early planted crops, on some of the alluvial soils of the Boonah, Gympie and Beaudesert districts, and could profitably be used to a much greater extent. Plantings made in July or August to catch the early market will almost certainly require irrigation to bring them through to maturity. Such crops may be planted in moist soil which has been given a good pre-planting irrigation, or set in dry soil and watered in. While the latter practice may be less wasteful of water, the pre-planting watering will enable a crop of weeds to germinate and be harrowed out before the cash crop is sown. One to three subsequent waterings may be required to carry the crop to flowering stage, when irrigation normally ceases.

Pumpkins, squashes and marrows grown as market-garden crops in the vicinity of the larger cities are mainly grown under irrigation; this of course applies particularly to crops grown outside the normal summer wet season.

In most districts in which the cucurbits are grown under irrigation, spray systems are used. Ground sprays are normally used in the agricultural districts, and overhead sprays in some of the market-garden areas. In the Bowen delta country, however, flood irrigation is used almost exclusively. Drills are opened up to a depth of five or six inches and the open drills flooded prior to planting. The seed is then dropped in the open furrows and scuffled in lightly. Two or three waterings are applied in the original drills up till the flowering period, and the irrigation is normally completed by one final watering subsequent to flowering.

FLOWERING AND SETTING.

Early flowering depends on the strength and vigour of the young plants, and if growth is rapid, flowering is early, thus enhancing the prospects of a good yield. Flowering may extend over a period of several weeks, both male and female flowers being produced on the same vine. The male flowers are the first to appear; they are borne on long, slender flower stalks not far from the crown of the plant, and are readily visible above the foliage. The female flowers are carried on short, stout stems toward the ends of the runners, and are easily recognised by the ovary or undeveloped fruit which can be seen immediately below the showy portion of the flower.

The flowers are open for 24 hours, and pollination, which is effected by insects, chiefly honey bees, takes place mostly in the early morning, but may occur at any period when the flowers are open. Pollen is carried from the male flowers to the female flowers, and fertilization is thus effected.

It is generally claimed that a better setting of fruit is obtained when cross-pollination occurs. Setting may vary with the variety and to some extent with the strain within the variety, and may be adversely affected by disease incidence or unfavourable weather. Only a small proportion of the female flowers set fruit, even though all may be fertilized. The shedding of fruiting flowers is a natural phenomenon and cannot be corrected except by the selection of better strains and varieties in which the phenomenon is less marked than in others. The nipping or cutting-back of vines is not calculated to increase the yield. It can only very slightly increase the size of the fruit set, and as all female flowers are borne towards the terminals of the plant, it removes potential fruiting portions of the crop.

SEED SELECTION.

With the cucurbit crops, as with maize and other cross-pollinating crops, seed selection is of vital importance if varieties are to be maintained at a reasonable standard of purity. A notable example of the variability which can occur through uncontrolled pollination is the Queensland Blue variety of pumpkin. Almost any field of this variety shows considerable variability in the type and quality of the fruit. Moreover, the fruit type regarded as true to the variety in one district or on one farm may be altogether different from that in another district or even upon a neighbouring farm. Careful seed selection is essential if type and uniformity are to be improved in a mixed variety, or maintained in a variety which is already of high standard.

It has also been pointed out that selected varieties or strains may be capable of setting a greater number of fruit per vine than material which has not been selected for this characteristic. Thus selection may be the means of increasing yield as well as quality and uniformity.

The barn selection of individual fruit for seed requirements is unwise, since the fruit selected may be from low-yielding vines or may be exceptional individuals from a vine of otherwise poor quality fruit. It is therefore necessary for seed selection to be carried out in the field. This is not as difficult as may at first appear, since, after the leaves have fallen, individual vines are fairly distinctively traced. Only well-shaped fruit, true to type and from vines of high yielding capacity, should be selected. Precautions must also be taken against possible crossing with other varieties, as has been outlined in a previous section.

Ten pounds of pumpkin will provide approximately one pound of seed; consequently selections need not be extensive. Contrary to popular opinion, the age of the seed, provided germination is not impaired, has no influence upon the yield of the subsequent crop. New season's seed has by experiment been shown to bear just as heavily as seed of older origin.

HARVESTING.

Squashes and marrows are usually harvested for market before they reach maturity—that is, before the rind or shell commences to harden. A simple test can be applied by pressing the rind with the thumb-nail, which, if the fruit is at the correct stage, should penetrate the rind under only light pressure. If such fruit are allowed to mature fully, the flesh becomes coarse and fibrous.

The scallop type of bush squash (or custard squash) is in excellent condition for table use when only two to three inches in diameter, and, when grown for home consumption, is often picked at that stage. It is normally harvested at a considerably later stage, however, when required for market.

Pumpkins and grammas are harvested when fully mature, usually after the vines have been frosted or have otherwise died off. Pumpkins harvested in an immature condition may be satisfactory for immediate home use but are unsuitable for market or storage. Such fruit are very susceptible to bruising, and losses through rotting may be very heavy. When the stage of full maturity has been reached in the field, the fruit should be harvested and put under cover before excessive sunburning can occur.

Where pumpkins and grammas are broken off clean from the fruit stalk, the scar left at the point of junction represents a weak spot for the entrance of fruit-rotting organisms. A short length of stalk should therefore be left attached to the fruit when it is picked; this is especially important if the crop is intended for distant market or for storage. Care must also be taken in handling the harvested fruit, as any unnecessary bruising or skin-cracking will react seriously against their keeping quality.

STORAGE.

Storage of pumpkins and grammas applies mainly to the late summer and autumn crops, which are normally harvested in the early winter period. Spring crops are not so well suited to storage,

because the warm humid weather of summer encourages fairly rapid deterioration. The main purposes of storage are twofold:— (1) to provide the farmer with stock food over the winter months, and (2) to enable him to market his produce outside the glut period.

All fruit to be stored must be mature and free from cuts and bruises. For long storage it is essential that the fruit be kept dry and as cool as practicable, with free access of air throughout. On many farms pumpkins and grammas are thrown carelessly into a heap in the corner of a yard or up against a barn, with the result that almost total losses may occur through bruising, sweating, and eventual decay. Storage therefore should always be in single layers in a cool and well aerated space.

Frequently a large hayshed or barn may provide the necessary floor space for storage of the crop under such conditions. If sufficient floor space is not available, wooden racks should be constructed to accommodate the fruit in single layers.

Where pumpkins and grammas are stored for farm use, and where indoor storage is not available, it will pay the farmer to select a clean, dry, well-drained area of land and to store the fruit in a single layer on this site. A covering of dry grass or straw will protect the crop from the sun and to some extent from rain. Inspections should, however, be made from time to time so that partially decaying fruit can be removed and either utilised or destroyed.

Smaller quantities of fruit for culinary use can often be kept for long periods on benches underneath the house or in other cool, well-aerated places round the farm house or buildings.

YIELDS.

While statistics show the State's average yield of pumpkins to be just in excess of 2½ tons per acre, this figure is of course a low one for good farming practice. On good fertile soils in south-eastern Queensland, particularly where irrigation can be applied, yields of more than five tons per acre should be easily attainable. Many well-tended crops of table pumpkins have yielded five to eight tons per acre, while yields of 10-12 tons per acre have been claimed for the mammoth types of cattle pumpkin. On poorer soils and under dry-farmed conditions, yields generally range from 30 cwt. to four tons per acre. In northern districts, under natural rainfall conditions, yields of 4-5 tons per acre are common, while irrigated crops in the Bowen district often exceed eight tons per acre.

Squashes and marrows grown under market garden conditions should yield more heavily than pumpkins because of the bush habit of most varieties and the closer plant spacings used. Yields of 8-12 tons per acre should easily be attainable where water is available and sound manuring practices applied.

With the large stock types of gramma, yields are very similar to those obtained with cattle pumpkins.

VARIETIES.

Pumpkins (Cucurbita maxima).

Queensland Blue or *Beaudesert.*—This variety, developed in the Beaudesert district of Queensland, has gained popularity in other Australian States and is by far the most widely grown variety of

table pumpkin in Queensland. The variety's origin is somewhat uncertain, but one of its parents is certainly the old Ironbark variety and a second parent is probably Crown. When the variety first became popular it was not fully fixed, and as a result many different strains exist today. The fruit type regarded as true "Beaudesert" may differ very markedly from district to district and even from farm to farm in the one district. Furthermore, in some districts it has been customary to give the name "Beaudesert" to one general type of fruit and "Queensland Blue" to a different fruit type altogether; in other districts again, the name "Beaudesert Blue" is applied to the whole varietal complex. There is, however, no definite evidence to suggest that the two names Queensland Blue and Beaudesert are not synonymous.

The typical fruit of this variety as represented in the Beaudesert district is a compact, medium table pumpkin with a steely blue-grey skin. In shape, it is quite deep in relation to its width and is fairly deeply and regularly ribbed; its sides have a pronounced taper from top to bottom, this taper being sometimes almost straight and at other times with a pronounced constriction near the middle (see Plate 74). The skin is hard and relatively thick, and the flesh should be of good thickness, hard but uniform in texture, and of a rich yellow or orange colour. The mature flesh when cooked should be dry and of excellent flavour. The variety is normally a good yielder and the fruits store well under favourable conditions.

Plate 74.

Pumpkins—Beaudesert or Queensland Blue. This sample shows a less pronounced taper and a broader disc at the blossom end than other strains of the variety.

Triamble or *Triangle*.—This variety (Plate 75) is characterised by the convoluted hexagonal shape of the fruit when viewed from either stem end or blossom end. It is grey to grey-green in colour and has a deep golden-coloured flesh of firm texture. The variety is of difficult shape for packing but is a good home or farm type since it yields well and has good keeping qualities.

Ironbark.—This variety was once a very popular table type but has for many years been largely replaced by Queensland Blue. It is characterised by its very hard skin and very corrugated ribbing.

Plate 75.
Pumpkins—Triamble Variety.

Crown.—While still grown to some extent, Crown (Plate 76) has also been largely displaced by Queensland Blue. It is an evenly ribbed, medium-large pumpkin with a slate-coloured skin and a yellow flesh of good cooking quality. Its name is derived from the prominent crown or protrusion at the blossom end of the fruit.

Turk's Head or *Turban*.—In this variety the crown is far more prominent than in the preceding variety, giving the appearance of a "pumpkin within a pumpkin" (Plate 77). Some strains of this variety are very striking in appearance as the crown or turban is usually variegated and the dominant colour may be either red or green.

Hubbards.—This general varietal type comprises a number of strains such as Green Hubbard, Golden Hubbard and Warted Hubbard. The fruit is broadly pear-shaped, but tapers to a blunt point at both stem and blossom ends. The Hubbards are good table types which

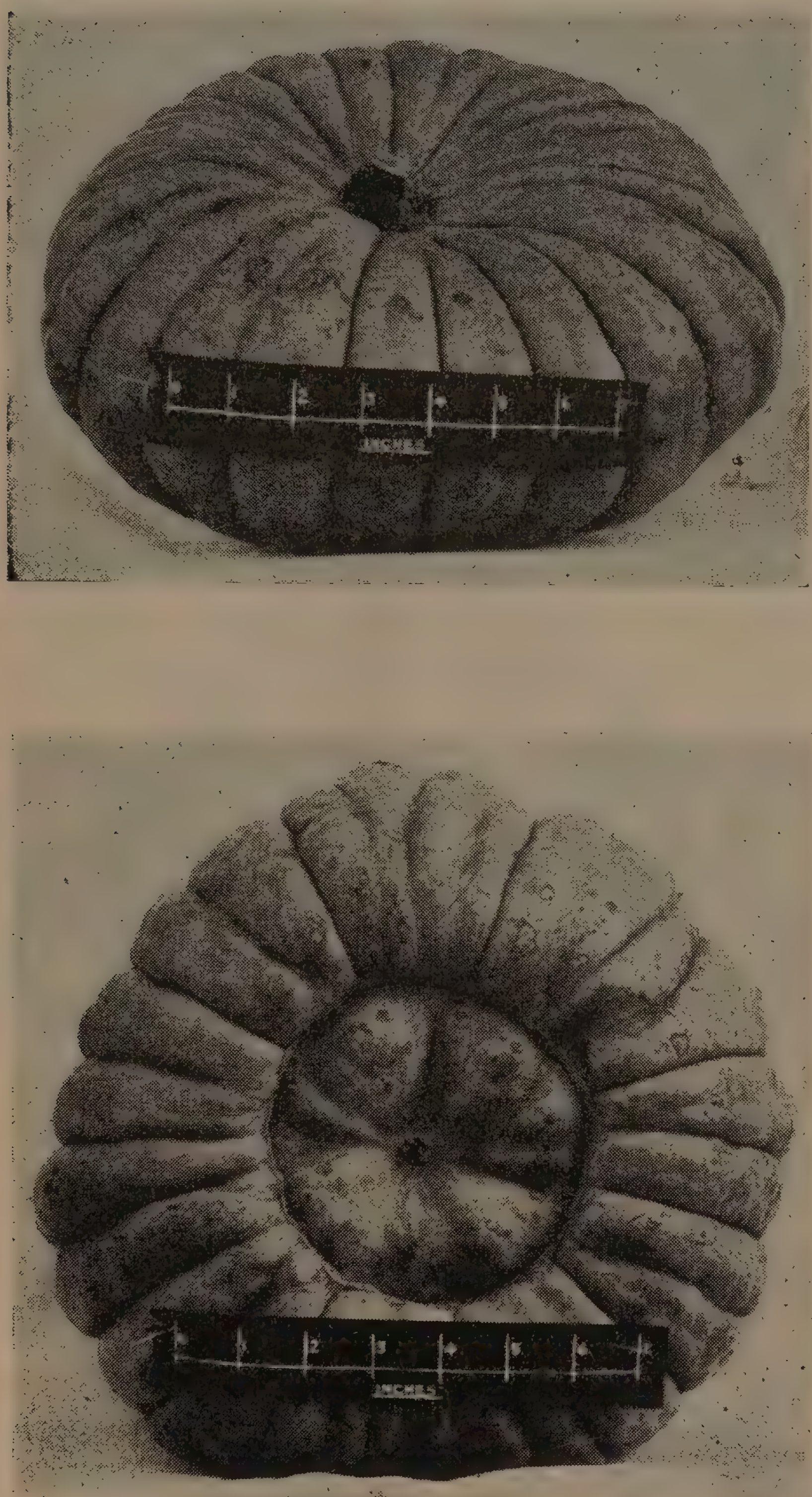

Plate 76.
Pumpkins—Crown Variety.

mature early and store well. They are not commonly encountered in Australia, but represent one of the most popular cucurbit varieties in the northern United States.

Banana.—The Banana pumpkin is somewhat similar to the Hubbard but is more elongated, and has a softer rind. The variety is normally greyish-green in colour and is reputed to be well flavoured.

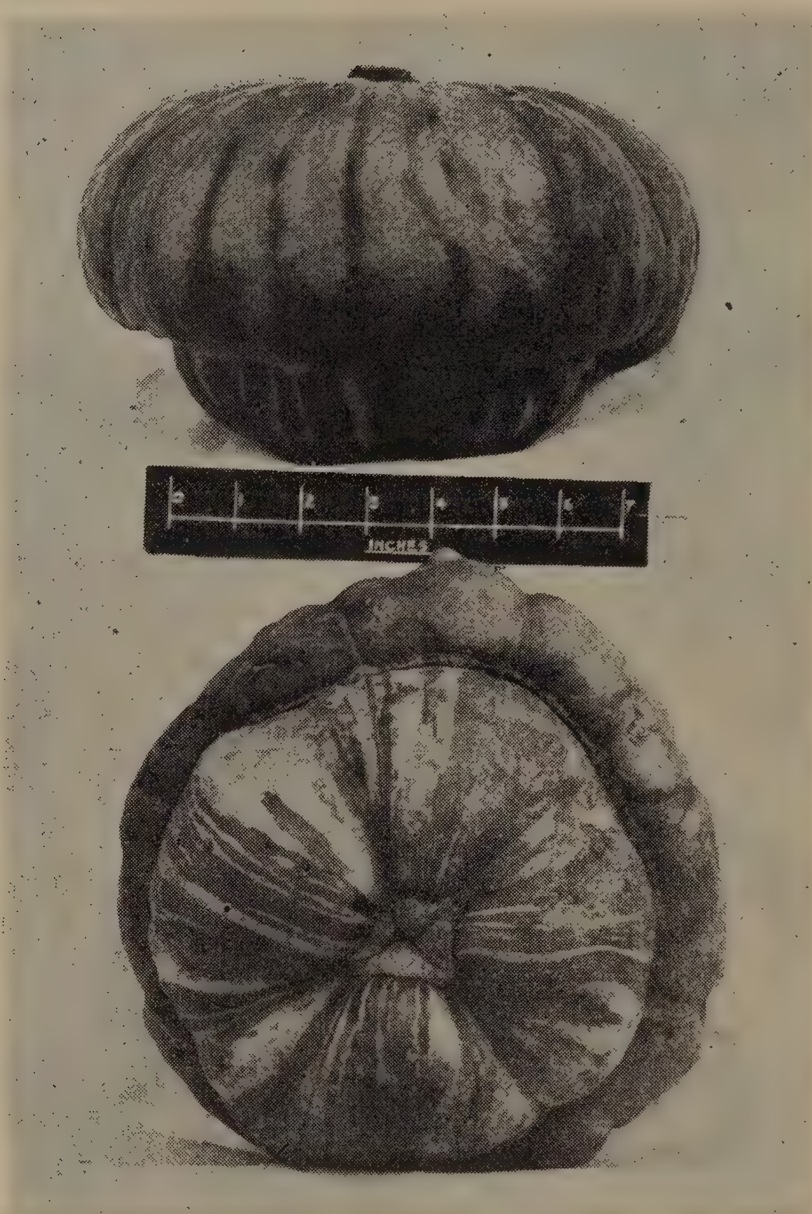

Plate 77.

Pumpkins—Turk's Head or Turban Variety.

Cattle Pumpkins.—(Plate 78). Though a number of distinct varieties of cattle pumpkin, such as Mammoth Cattle, Mammoth Yellow and Mammoth Chili, are recognised in various countries, seed is frequently sold here in mixed lots. Though minor differences may be observable between some of these varieties, all are large in size (frequently weighing between 100 and 200 lb.) with large seed cavities. The flesh is usually coarse, pale and soft, and the rind is softer than that of many of our table pumpkins; as a result they do not normally store well. The type is really misnamed in this country as they are grown mainly for pig-feeding, and few crops, if any, find their way into cattle food.

Plate 78.

Pumpkins—Mammoth Cattle Variety. This specimen weighed 120 lb. and is regarded in the Beaudesert district as of ideal size and type.

Marrows and Squashes (Cucurbita pepo).

Vegetable Marrows.—The fruits of the vegetable marrows are normally elongated and cylindrical, or slightly swollen at the blossom end (Plate 79). The skin is smooth and the flesh white. Both bush and runner varieties exist but the bush type is most popular in this country. The Long White Bush marrow is probably the commonest

Plate 79.

Marrows—Yellow Striped and Long Cream Bush Varieties.

variety, but the Long Green Bush and the Long Creamy marrows are also in cultivation. These varieties are easily distinguishable by the skin colours of the mature fruit.

Scallops, Patty Pans, Custard Squashes.—This group of varieties is distinguished by the disc-shaped fruit with its symmetrically scalloped outline (Plate 80). Early White is probably the most popular variety; it has white skin and flesh and is a rapid and prolific bearer. Early Golden Bush and Golden Custard are two other varieties of scallop, but neither of them bears as freely as the Early White variety.

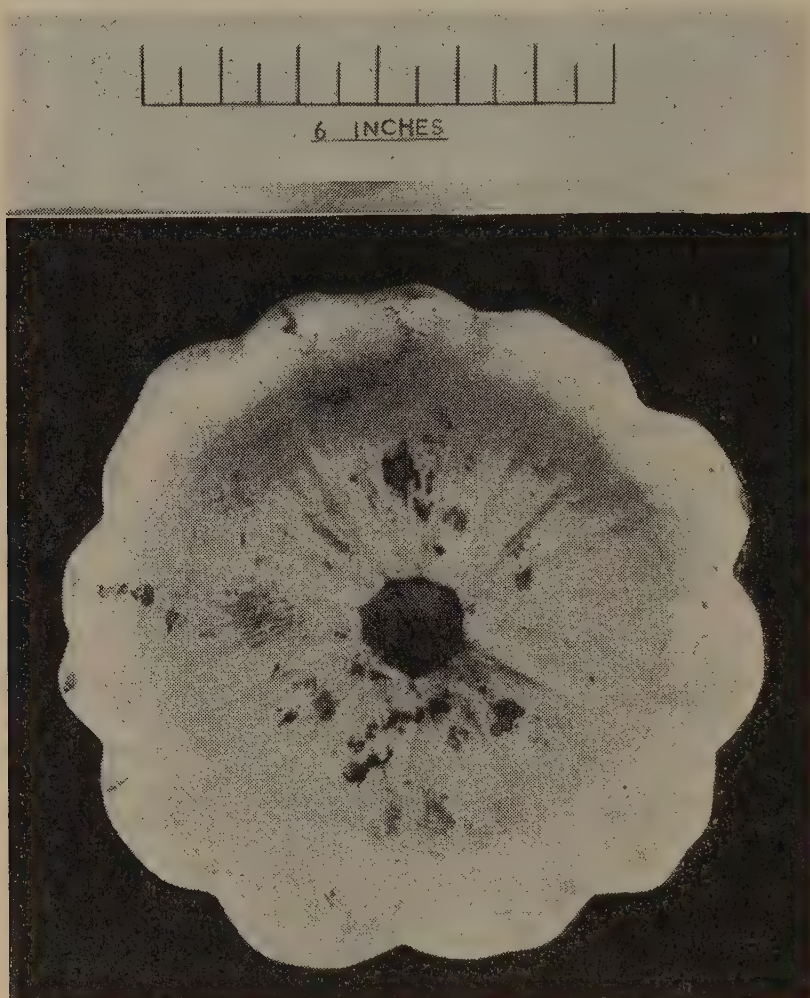

Plate 80.
Scallop or Custard Squash—Early White Bush Variety.

Sugar Squashes.—This group includes both small and large fruited types which are of no importance in Australia. Two large running varieties which are unsuited for table use and would popularly be classed with the cattle pumpkins are Mammoth Tours and Connecticut Field.

Fordhook Squashes.—This is another minor group of squashes including small fruited table types such as Table Queen. This variety is small, dark green, acorn-shaped, and grooved, with rich orange flesh of good flavour.

Crookneck Squashes.—This group derives its name from the shape of the fruit, which must not be confused, however, with the Bugle type of gramma. Yellow Crookneck has a bright yellow, warted skin and yellow flesh, and is reputed to be a prolific yielder.

Grammas (Cucurbita moschata).

Bugle.—This variety (Plate 81), often erroneously known as the Bugle "pumpkin," is one of the most widely known grammas. It produces a large crookneck fruit with a slightly swollen stem end and a much swollen blossom end. The skin is a brownish buff colour when mature, and the flesh is orange-coloured and sweet. This is the most popular cucurbit variety for the making of jams and pies. In common with other grammas, it has good keeping qualities, and makes a useful stock food.

Plate 81.
Gramma—Bugle Variety.

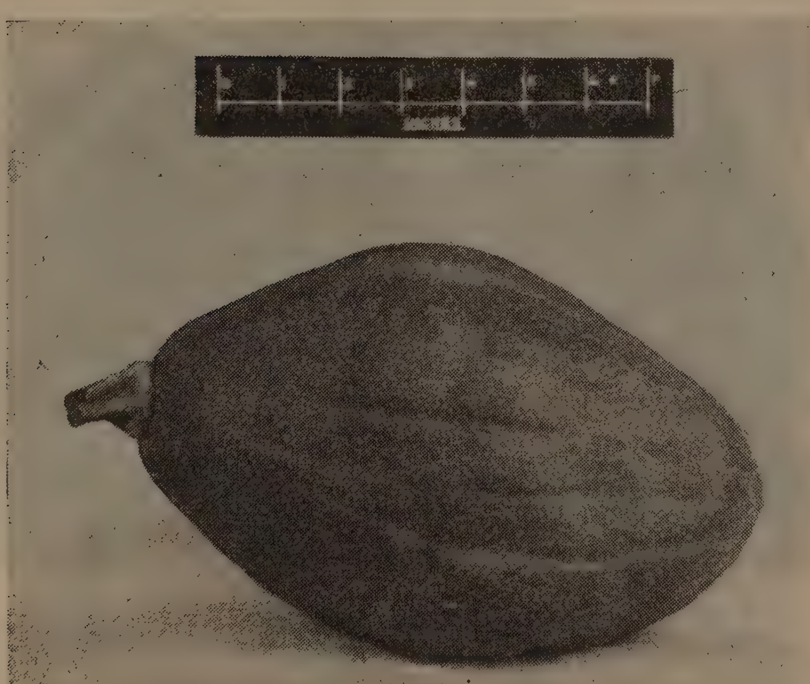

Plate 82.
Gramma—Papaw Variety.

Papaw.—The Papaw gramma (Plate 82), which is also misnamed Papaw "pumpkin," is a small gramma with a papaw-shaped fruit. This variety is probably the best of all the grammas for home gardens and for table use. The fruit are of good size for family requirements, and the variety merits far wider popularity than it at present enjoys.

Stock Grammas.—Other stock grammas include such varieties as Mammoth Round, Giant Long, Pear (Plate 83) and Large Cheese (Plate 84). These varieties are seldom seen in pure stand, however, but may occasionally be found in paddocks of so-called mixed "pumpkins."

Plate 83.
Gramma—Stock Variety of the Pear Type.

Plate 84.
Gramma—Stock Variety of the Large Cheese Type.

PESTS AND DISEASES.

The major pests of the cucurbit crops dealt with in this article are the pumpkin beetles and the leaf-eating ladybird. Both types of beetle are almost universally present on these crops and may in certain

instances do considerable damage if not checked. The recommended treatment for these pests is a dust containing 25 per cent. of arsenate of lead in a hydrated lime or kaolin carrier. The dust should be applied thoroughly when the air is still, preferably in the early morning when the dew is present on the plants. If the treatment is carefully applied at intervals during the earlier stages of growth, a vigorous crop should not require treatment in the fruiting stages when there would be a risk of accumulating poisonous residues on the maturing fruit.

Other insect pests which may occasionally menace the successful growth of these crops include aphids, thrips, red spider, caterpillars, stem borers and shield bugs, all of which are dealt with fully in the Division of Plant Industry's Pamphlet No. 101, entitled "Pests of Cucurbit Crops."

The most common disease of the cucurbit family is powdery mildew, which is easily recognised by the white floury patches found on both sides of the leaves. If vines are vigorously growing the disease usually causes little loss, but when plant growth is checked the fungus may become destructive. The recommended control measure is a dusting with sulphur or a mixture of equal parts of sulphur and hydrated lime. Both surfaces of the leaves should be covered, and applications should be repeated as the disease reappears.

Details of combined insecticidal and fungicidal treatments may be found in Pamphlet No. 101. For further information relating to pests and diseases of these crops, reference should be made to the Science Branch of the Department of Agriculture and Stock.

BONE IN PUMPKINS.

A frequent occurrence in pumpkins is the formation of "bone" or "woodiness" in the flesh. This "bone" comprises hard woody tissue which may vary in size and distribution from small granules to large irregular lumps. In extreme cases, almost the whole of the flesh of the fruit may be "bone." The phenomenon is not restricted to any one variety, and has been observed in soft mushy fruit as well as in fruit of otherwise excellent flavour and texture.

The presence of "bone" can generally be detected in the uncooked flesh of the pumpkin, either by variation in the resistance to cutting or by the mottled appearance of the flesh. When present only in small degree, this condition considerably reduces the palatability of the vegetable, while in extreme cases it may render the material completely inedible.

While many theories have been advanced to explain the occurrence of "bone," no entirely satisfactory explanation has yet been offered. The trouble has been variously ascribed to drought, to excessive water, to insect punctures during early growth, and to planting seed from affected pumpkins. Whatever the cause may finally prove to be, there is no definite evidence that the characteristic is inherited. Such being the case, there seems little point in recommending the selection of "bone"-less fruits for seed production.

The probability is that the condition is a physiological one, which might well be tied up with irregularity of water supply to the developing fruits. Should this be true, little could be done under rain-grown conditions to alleviate the trouble. Where irrigation is available, the object should be to keep the plants moving without check, and to avoid if possible either excessively wet or dry conditions.

TUBERCULOSIS-FREE CATTLE HERDS.
(AS AT 15th FEBRUARY, 1952.)

Breed.	Owner's Name and Address of Stud.
Aberdeen Angus	The Scottish Australian Company Ltd., Texas Station, Texas F. H. Hutton, "Bingegang," Dingo
A.I.S.	F. B. Sullivan, "Fermanagh," Pittsworth D. Sullivan, "Bantry" Stud, Rossvale, *via* Pittsworth W. Henschell, "Yarranvale," Yarranlea Con. O'Sullivan, "Navillus Stud," Greenmount H. V. Littleton, "Wongalea Stud," Hillview, Crow's Nest J. Phillips and Sons, "Sunny View," Kingaroy Sullivan Bros., "Valera" Stud, Pittsworth Reushle Bros., "Reubydale" Stud, Ravensbourne H. F. Marquardt, "Chelmer," Wondai W. G. Marquardt, "Springlands," Wondai A. C. and C. R. Marquardt, "Cedar Valley," Wondai A. H. Sokoll, "Sunny Crest," Wondai
Ayrshire	L. Holmes, "Benbecula," Yarranlea J. N. Scott, "Auchen Eden," Camp Mountain "St. Christopher's and Iona" Studs, Brookfield Road, Brisbane E. Mathie and Son, "Ainslie" Ayrshire Stud, Maleny
Friesian	C. H. Naumann, "Yarrabine Stud," Yarraman J. F. Dudley, "Pasadena," Maleny
Guernsey	C. D. Holmes, "Springview," Yarraman
Jersey	W. E. O. Meier, "Kingsford Stud," Rosevale, *via* Rosewood J. S. McCarthy, "Glen Erin Jersey Stud," Greenmount J. F. Lau, "Rosallen Jersey Stud," Goombungee G. Harley, Hopewell, Childers Toowoomba Mental Hospital, Willowburn Farm Home for Boys, Westbrook F. J. Cox and Sons, "Rosel" Stud, Crawford, Kingaroy Line R. J. Browne, Hill 60, Yangan P. J. L. Bygrave, "The Craigan Farm," Aspley A. Verrall and Sons, "Coleburn Stud," Walloon R. J. Crawford, "Inverlaw Jersey Stud," Inverlaw, Kingaroy P. H. F. Gregory, "Carlton," Rosevale, via Rosewood E. A. Matthews, "Yarradale," Yarraman A. L. Semgreen, "Tecoma," Coolabunia G. & V. Beattie, "Beauvern," Antigua, Maryborough L. E. Meier, "Ardath" Stud, Boonah A. M. and L. J. Noone, "Winbirra" Stud, Mt. Esk Pocket, Esk

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Planting Tables for Vegetable Crops.

Prepared by Officers of the Horticulture Branch.

THE State of Queensland occupies the north-eastern corner of the Australian continent and lies between latitudes 28 degrees south and 12 degrees south. It covers an area of 670,500 square miles. The climate is far from uniform, and as climate largely determines what crops can be grown and the period of the year in which they may be planted, a single crop planting table for the whole State could be very misleading. For practical purposes, therefore, the State is conveniently divided into southern, central and northern Divisions. These are merely geographical units, and within each some zoning in terms of altitude and distance from the coast is useful when grouping horticultural districts. Altitude can bring the mild temperatures and the short cropping seasons of temperate areas into subtropical and tropical latitudes. Thus the Granite Belt in southern Queensland and the Atherton Tableland in the far north can grow some crops during the summer months when production on the adjacent coastal areas would be quite impracticable. Similarly, the climate of the inland is distinctive, for temperatures there are less equable than they are nearer the coast where the influence of coastal winds is apparent. Inland areas are, therefore, characterised by hot summers, cold winters and a daily temperature range which is fairly wide.

All crop planting tables must be interpreted in terms of local conditions. In these tables, the southern Division is subdivided into coastal, tableland, and inland districts, but in the central and northern Divisions, the tableland and inland districts are merged into one. This is due primarily to the fact that, climatically, the tableland and inland areas of central and northern Queensland have a great deal in common. In each of the subdivisions, current practices in a key centre have been used in compiling the data. Hence, when the table is consulted, practices in the nearest key centre should indicate the procedure to be followed on any particular property. Adjustments can, of course, be made to suit individual cases. The key centres are as follows:—

Division.	Coastal.	Tableland.	Inland.
Southern	Brisbane	Stanthorpe	Charleville
Central	Rockhampton	Emerald Barcaldine	
Northern	Cairns Bowen	Atherton Charters Towers	

Divisions.

The southern Division extends from the Queensland-New South Wales border to Miriam Vale and west from the coast. The rainfall near the coast varies from 40 to 75 inches and drops sharply with the distance of the locality from the coast. About 60 per cent. of the total annual rain falls between October and March. During the autumn, winter, and spring months, volume production of vegetables is concentrated within 100 miles of Brisbane, the capital city. Stanthorpe is the main producing area during the summer months. Fairly substantial quantities of most crops are, however, grown for local consumption near important country towns such as Toowoomba, Maryborough, and Bundaberg.

The central Division extends from Miriam Vale to slightly north of Mackay and includes all areas west of the coastline between these towns. Although heavier rains occur in the Mackay area, the annual coastal rainfall is usually about 40 inches and the amount tapers off rapidly further inland. About 65 per cent. of the annual rain falls during the October-March period, but the rain is rather unreliable, particularly between April and December, as most of this Division lies within a relatively dry region close to the Tropic of Capricorn. Sometimes both summer and winter rain influences are favourable and good seasonal conditions operate; sometimes both are unfavourable and droughts occur. Vegetable production in the Central Division is more concerned with local rather than the large southern markets, but in some years substantial quantities of tomatoes are exported from areas near the coast.

The northern Division takes in that part of Queensland north of a line running west from the coast at Bloomsbury. The Division is characterised by a summer rainfall which is high (88 inches at Cairns) in the far north but relatively light (40 inches at Bowen) in the southern and western areas. The main vegetable producing district is Bowen, which specialises in the production of winter tomatoes for the southern markets. Substantial quantities of this and other staple vegetables are also grown at Charters Towers, Townsville, Cairns and on some parts of the Cairns hinterland, for local consumption. Crops are usually planted after the summer rains have ended and irrigation is essential for consistently high production.

Times of Planting.

Temperature normally determines the period of the year during which a crop can be grown, for each crop has its own particular requirements.

Some vegetables, such as turnips, cabbages and carrots, are more or less tolerant to the relatively mild frosts which occur in coastal areas. Others, such as beans and tomatoes, are on the other hand severely damaged by frost, and even cool temperatures without any actual frost are often sufficient to either inhibit fruiting or cause growth abnormalities which reduce yields or lessen the quality of the product. Frost-susceptible crops must, therefore, be planted when the frost risk is negligible during the growing period. On many coastal farms the topography is uneven, and frost risks are often kept to a minimum by siting each crop according to the period of the year. The upper slopes are usually less subject to frost than lower reaches of the foothills and this fact determines the placing of successive plantings in crops such as beans and tomatoes.

Spacing.

Crop management practices vary a great deal from district to district. For example, the tomato may be grown on the ground, or on cradles, trellises, or stakes according to grower preference, the variety and the time of the year. The plant spacings suggested in the tables should prove satisfactory under most conditions when the plant type is near the average for the group to which it belongs. If the plant spread is below average, as in the cluster tomatoes, closer spacing should be practicable. Conversely, if the plant spread is above average, as in some varieties of cabbage, wider spacing will be necessary. Normally, alterations in the planting distances should be made in the row; unless special considerations operate, the distance between rows is determined by the implements used for inter-row cultivation and should not be changed.

Rate of Sowing.

The rates of sowing given in the tables are those generally used when the ground is in good order and the viability of the seed is known to be good. If, for any reason, the ground has not been worked to a fine tilth before planting or the soil moisture at the time of planting is not particularly good, sowing rates may be increased by 20 per cent., unless, of course, germination can be assured by the use of irrigation. A similar increase in the sowing rate is also desirable when old seed of doubtful quality is being used for the crop.

Depth of Sowing.

The depth at which vegetable seeds are sown depends largely on the condition of the ground. Both upper and lower limits are supplied for each crop in the tables. Where the ground has been worked to a fine tilth, and this should normally be the case, shallow sowing is permissible. Where, however, thorough preparation of the land has not been practicable through unfavourable weather or lack of the right implements, deep planting is preferred, as conditions are more favourable for a good even germination when the seed is surrounded by fine particles of moist soil.

The depth of sowing is largely governed by the size of the seed, the amount of reserve food contained in it and the ability of the seedling to push its way through any crust which might form on the surface of the soil. Thorough soaking of the soil after planting and the application of a surface mulch are helpful in seed-beds, but frequent irrigation is desirable in field grown crops.

Period to Maturity.

The period from planting to the commencement of harvesting in any crop depends on the variety, its cultural treatment during the growing period, and the period of the year in which it is grown. A crop planted and grown under optimum temperature and moisture conditions bears fruit more quickly than the same crop grown under harsh conditions. In most of the more important vegetables, too, a wide range of varietal types is available. Some of these are early maturing and others are late maturing types, and both are useful to ensure continuity of production during the season.

SOUTHERN DIVISION.

SOWING AND PLANTING TABLE FOR MARKET GARDEN CROPS.

(The data in this Table may require modification for particular areas).

Crop.	When to Sow or Plant: Coastal Districts.	When to Sow or Plant: Tableland Districts.	When to Sow or Plant: Inland Districts.	How Sown or Planted: Distance Rows Apart.	How Sown or Planted: Distance between Plants.	How Sown or Planted: Quantity Seed per Acre if Drilled.	How Sown or Planted: Depth to Sow.	Period of Growth to Harvesting.	Remarks.
				Ft. In.	Ft. In.		In.	Months.	
Asparagus	Aug. and Sept.	September	..	4 0	1 6	7,260 crowns	5–6	30	May also be propagated from seed, the seedlings being transplanted when large enough, usually 1 year old
Bean (Broad)	Mar. to Apr.	Mar. to May	Mar. to May	2 6	0 8	2 bus.	1–2	4½–5	..
Bean (French)	Feb. to Sept.	Oct. to Jan.	Sept. and Mar.	2 6	0 5	40 lb.	1–2	2–3½	Sowings may be earlier or later according to the district's susceptibility to frost
Beetroot	Feb. to Oct.	Sept. to Feb.	Sept. to Feb.	2 6	0 5	5 lb.	¾	2½–4	When hilled, planted in double rows 10 in. apart, with 3 ft. centres
Beet (Silver)	Jan. to Sept.	Sept. to Mar.	Sept. to Mar.	2 6	1 0	4 lb.	¾	2½–4	..
Cabbage	Dec. to July	July to Dec.	July to Dec.	3 0	2 0	6 oz.	½–¾	3–5	Seed is planted in prepared beds and transplanted to the field when large enough to handle
Carrot	Feb. to Aug.	July to Jan.	July to Feb.	2 6	0 3	4 lb.	½–¾	3½–5	May be planted in double rows 10–12 in. apart, with 3 ft. centres
Cauliflower	Jan. to Apr.	Dec. to Feb.	Aug. to Dec.	3 6	2 9	4 oz.	½–¾	3½–5½	Seed is planted in prepared beds and transplanted to the field when large enough to handle
Celery	Feb. to May	Aug. to Dec.	Aug. to Dec.	3 0	0 7	3 oz.	¼	4–5	Usually planted in double rows 12 in. apart, with 3 ft. centres
Choko	Aug. to Oct.	..	Oct. and Nov.	Trellis	12 0	Choko fruit	Shoot 3 in. below ground	5–6	..
Cucumber	July to Mar.	Oct. to Dec.	Feb., Mar., Sept.	4 0	2 0	2 lb.	2	3–3½	Earlier or later plantings depend on frost risk
Egg Plant	Feb. to Aug.	..	Aug. to Dec.	4 0	3 0	1 oz. per 1,000 plants	..	4–5½	Earlier or later plantings depend on frost risk
Herbs—Mint	July and Aug.	Aug. and Sept.	Aug. and Sept.	2 6	1 3	..	..	2	Propagated by rootlets only

								3	Can also be propagated by plant division
Parsley	Nearly all seasons	Nearly all seasons	Aug. and Sept.	2 6	1 3	..	..	3	Can also be propagated by plant division
Sage	Aug. and Sept.	Aug. and Sept.	Aug. and Sept.	2 6	1 3	..	..	3	Can also be propagated by plant division
Thyme	Aug. and Sept.	Aug. and Sept.	Aug. and Sept.	2 6	1 3	..	..	3	Can also be propagated by plant division
Kohl Rabi	Feb. to June	Aug. to June	Aug. to Mar.	2 6	0 9	2 lb. ..	½–¾	3–4	..
Lettuce	All seasons ..	Aug. to Mar.	Aug. to May	1 6	0 9	1½ lb. ..	½	2–3	..
Marrow (Vegetable)	May to Feb.	Sept. to Dec.	Sept. to Jan.	4 0	2 6	2 lb. ..	1	3–4	..
Melon (Rock) ..	Aug. to Jan.	Oct. to Dec.	Sept. to Dec.	4 6	2 0	2 lb. ..	1	3	..
Melon (Water) ..	Aug. to Oct.	Oct. to Dec.	Sept. to Dec.	8 0	7 0	2 lb. ..	1	3–4	..
Parsnip	Feb. to May	July to Dec.	July to Dec.	2 6	0 4	2 lb. ..	½	5–6	May be planted in double rows 12 in. apart, with 3 ft. centres
Peas	Mar. to July	June to Oct.	Mar. to July	2 6	0 3	1 bus. ..	1–1½	3–5	Period of maturity depends on variety, time of year and district
Pumpkin	June to Jan.	Sept. to Jan.	Sept. to Jan.	9 0	3 6	2 lb. ..	1–1½	4½–6	Distance apart and time of maturity vary with the variety
Radish	All seasons ..	Nearly all seasons	Nearly all seasons	0 9	0 1½	10 lb. ..	¼–½	1–1½	..
Rhubarb	Jan. to Apr. ..	Aug. to Mar.	Mar. and Apr.	3 3	2 0	2 lb. ..	¾	4–5	Plants raised in seed-beds and transplanted to field
Rosella	Aug. to Nov.	Sept. and Oct.	Sept. and Oct.	5 0	3 6	2½ lb. ..	¾	4–4½	Sown in beds and transplanted
Shallot	Feb. to Sept.	All seasons ..	Mar. to Aug.	1 6	0 6	..	..	3	Propagated by division of the bulbs
Squash		As for Marrow	..	..	..	..	..	..	..
Strawberry	Mid-Mar. ..	March ..	March ..	Single Rows. 2 6	1 3	14,000 runners	4	..	..
				Double Rows 3 ft. 6 in. Centre. 1 3	1 3	20,000 runners			
Tomato	Jan. to Aug.	Aug. to Nov.	Aug. to Jan.	Ground Crop. 5 6	3 6	1 oz. seed per 2,000 plants	½	3½–5	Grown in prepared seed-beds and transplanted. Planting distance depends on variety and district
				Trellised. 4 6	1 6				
Turnip	Mar. to June	Feb. to Aug.	Mar. to July	2 6	0 5	2 lb. ..	½	2–3	..

CENTRAL DIVISION.

SOWING AND PLANTING TABLE FOR MARKET GARDEN CROPS.

(The data in this Table may require modification for particular areas).

Crop.	When to Sow or Plant.		How Sown or Planted.				Approximate Period of Growth to Harvesting.	Remarks.
	Coastal Districts.	Tableland and Inland Districts.	Distance Rows Apart.	Distance Between Plants.	Quantity Seed per Acre if Drilled.	Depth to Sow.		
			Ft. In.	Ft. In.		In.	Months.	
Asparagus	Aug.	..	4 0	1 6	7,260 crowns	5–6	30	Propagated from seed
Bean (Broad)	Mar. and Apr.	Mar. and Apr.	2 6	0 9	2 bus.	1–2	4½–5	..
Bean (French)	Mar. to Aug.	Aug. and Mar.	2 6	0 5	40 lb.	1–2	2–3½	Sowings may be earlier and later according to the district's susceptibility to frost
Beetroot	Feb. to Aug.	Mar. to Aug.	2 6	0 5	5 lb.	¾	2½–4	When hilled planted in double rows 10 in. apart, with 3 ft. centres
Beet (Silver)	Feb. to Aug.	Mar. to Aug.	2 6	1 0	4 lb.	¾	2½–4	..
Cabbage	Feb. to Sept.	Feb. to Sept.	3 0	2 0	6 oz.	½–¾	3–5	Seed is planted in prepared beds and transplanted to the field when large enough to handle
Carrot	Feb. to Aug.	Mar. to June	2 6	0 3	4 lb.	½–¾	3½–5	May be planted in double rows 10–12 in. apart, with 3 ft. centres
Cauliflower	Feb. to May	Feb. to May	3 6	2 9	4 oz.	½–¾	3½–5½	Seed is planted in prepared beds and transplanted to the field when large enough to handle
Celery	Feb. to Apr.	Feb. to Apr.	3 0	0 7	3 oz.	¼	4–5	Usually planted in double rows 12 in. apart, with 3 ft. centres
Choko	July to Oct.	Sept. and Oct.	Trellis	12 0	Choko fruit	Shoots 3in. below ground	5–6	..
Cucumber	May to Aug.	Aug. and Feb.	4 6	2 0	2 lb.	2	3–3½	..
Egg Plant	Feb. to Aug.	July to Sept. and Jan. to Feb.	4 0	3 0	1 oz. per 1,000 plants	..	4–5½	..
Herbs— Marjoram	Aug.	Aug. and Sept.	2 6	1 3	..	..	3	Can also be propagated by plant division
Mint	Aug.	Aug. and Sept.	2 6	1 3	..	..	2	Propagated by rootlets only
Parsley	Nearly all seasons	Aug. and Sept.	2 6	1 3	..	..	3	Can also be propagated by plant division

Sage	Aug. and Sept.	Aug. and Sept.	2 6	1 3	..	..	3	Can also be propagated by plant division
Thyme	Aug. and Sept.	Aug. and Sept.	2 6	1 3	..	..	3	Can also be propagated by plant division
Kohl Rabi	Mar. to June	Mar. to July	2 6	0 9	2 lb. ..	½–¾	3–4	..
Lettuce	Feb. to Oct.	Feb. to Sept.	1 6	0 9	1½ lb. ..	½	2–3	..
Marrow (Vegetable) ..	Feb. to Sept.	Feb., Aug., Sept.,	4 0	3 0	2 lb. ..	1	3–4	..
Melon (Rock)	July to Nov.	Aug. to Oct.	4 6	2 0	2 lb. ..	1	3	..
Melon (Water)	July to Oct.	Sept. and Oct.	8 0	7 0	2 lb. ..	1	3–4	..
Parsnip	Mar. to May	Mar. to May	2 6	0 4	2 lb. ..	½	5–6	May be planted in double rows 12 in. apart, with 3 ft. centres
Pea	Mar. to June	Mar. to June	2 6	0 3	1½ bus. ..	1–1½	3–5	Period of maturity depends on variety, time of year and district
Pumpkin	Feb. to June	Aug. and Jan.	9 0	3 6	2 lb. ..	1–1½	4½–6	..
Radish	All seasons	All seasons	0 9	0 1½	10 lb. ..	¼–½	1–1½	..
Rhubarb	Feb. to Apr.	Mar. to May	3 3	2 0	2 lb. ..	¾	4–5	Plants raised in seed-beds and transplanted to field
Rosella	Aug. to Feb.	..	5 0	3 6	2½ oz. ..	¾	4–4½	Sown in beds and transplanted
Shallot	Feb. to Aug.	Feb. to Aug.	1 6	0 6	..	..	3	Propagated by division of bulbs
Squash	..	..	As for Marrow					
				Single Row.				
Strawberry	Mar.	Mar.	2 6	1 3	14,000 plants	..	4	..
				Double Row. 3 ft. 6 in. centres.				
..	..	..	1 3	1 3	20,000 plants	..	..	..
				Ground Crop.				
Tomato	Feb. to Aug.	Feb., Aug.	6 to 10 feet	3 to 10 feet	1 oz. seed per 2,000 plants	½	3½–5	Grown in prepared seed-beds and transplanted. Planting distance depends on variety and district
				Trellised.				
			5 0	1 6				
Turnip	Mar. to June	Mar. to July	2 6	0 5	2 lb. ..	½	2–3	..

NORTHERN DIVISION.

SOWING AND PLANTING TABLE FOR MARKET GARDEN CROPS.

(The data in this Table may require modification for particular areas).

Crop.	When to Sow or Plant.		How Sown or Planted.				Approximate Period of Growth to Harvesting.	Remarks.
	Coastal Districts.	Tableland and Inland Districts.	Distance Rows Apart.	Distance Between Plants.	Quantity Seed per Acre if Drilled.	Depth to Sow.		
			Ft. In.	Ft. In.		In.	Months.	
Asparagus	..	Sept.	4 0	1 6	7,260 crowns	5–6	30	May be grown only in the tablelands and comparatively cooler districts
Bean (French)	Mar. to Sept.	Aug. to Apr.	2 0	0 5	40 lb.	1–2	2–3	Sowings may be made earlier or later according to the district's susceptibility to frost
Beetroot	Mar. to Aug.	Feb. to Sept.	2 6	0 9	4 lb.	..	$2–3\frac{1}{2}$	..
Beet (Silver)	Mar. to Aug.	Feb. to Sept.	2 6	1 0	$4\frac{1}{2}$ lb.	$\frac{3}{4}$	$2\frac{1}{2}–4$	..
Cabbage	Feb. to June	Jan. to July	3 0	2 0	6 oz.	$\frac{1}{2}–\frac{3}{4}$	$2\frac{1}{2}–3\frac{1}{2}$	Seed is planted in prepared beds and transplanted to the field when large enough to handle
Carrot	Feb. to July	Feb. to Sept.	2 6	0 3	4 lb.	$\frac{1}{2}–\frac{3}{4}$	$3\frac{1}{2}–4\frac{1}{2}$	May be planted in double rows 12 in. apart, with $2\frac{1}{2}$ ft. centres
Cauliflower	Feb. to Apr.	Feb. to May	3 6	2 9	4 oz.	$\frac{1}{2}–\frac{3}{4}$	3 5	Seed is planted in prepared beds and transplanted to the field when large enough to handle
Celery	..	Feb. to Apr.	4 0	0 6	3 oz.	$\frac{1}{4}$	4–5	..
Choko	Apr. to July	Aug. to Nov.	Trellis	6 0	Choko fruit	Shoot 3 in. below ground	$3\frac{1}{2}–5$	..
Cucumber	June to Apr.	July to Mar.	5 0	2 0	$1\frac{1}{2}$ lb.	2	2–3	..
Egg Plant	Mar. to July	Nov. to Feb.	3 6	3 0	1 oz. per 1,000 plants	..	$3\frac{1}{2}–5$	..
Herbs— Marjoram	..	Aug. and Sept.	2 6	1 3	..	..	4–6	Can also be propagated by plant division
Mint	Mar. to Aug.	Aug. and Sept.	2 6	1 3	..	..	4–6	Propagated by rootlets only
Parsley	Mar. to Aug.	Aug. and Sept.	2 6	1 3	..	..	4–6	Can also be propagated by plant division
Sage	..	Aug. and Sept.	2 6	1 3	..	..	4–6	Can also be propagated by plant division
Thyme	..	Aug. and Sept.	2 6	1 3	..	..	4–6	Can also be propagated by plant division

Kohl Rabi	Mar. to May	Mar. to June	2 6	1 6	2 lb.	½–¾	3–3½	..
Lettuce	Mar. to Sept.	Feb. to Oct.	2 0	0 9	1½ lb.	½–¾	2–3	..
Marrow (Vegetable)	Apr. to Oct.	Aug. to Feb.	6 0	3 0	2 lb.	1	2½–4	Distance apart and time of maturity depend on variety
Melon (Rock)	July to Oct.	Aug. to Feb.	5 0	2 0	2 lb.	1	2½–3½	Distance apart and time of maturity depend on variety
Melon (Water)	July to Oct.	Aug. to Nov.	8 0	7 0	2 lb.	1	3–4	..
Parsnip	Mar. and Apr.	Feb. to May	2 6	0 6	2 lb.	½	6–7	..
Pea	Mar. to May	Feb. to June	2 6	0 3	1 bus.	1–1½	3–5	Period to maturity depends on variety
Pumpkin	Mar. to July	Aug. to Feb.	9 0	3 6	2 lb.	1–1½	4–6	Distance apart and period to maturity vary with the variety
Radish	Nearly all seasons		1 0	0 1½	10 lb.	¼–½	1–1½	..
Rhubarb	Mar. to May	Mar. to June	3 6	3 0	2 lb.	¾	4–5	When propagated from roots, quicker returns may be expected
Rosella	Aug. to Feb.	Sept. to Jan.	5 6	3 9	2½ lb.	¾	3½–4½	..
Shallot	Mar. to Aug.	Mar. to Aug.	1 6	0 6	..	..	2½–3½	Propagated by division of bulbs
Squash	As for Marrow							
Strawberry	..	Mar. ..	Single Rows. 2 6	1 3	14,000 plants	..	..	..
			Double Rows. 3 ft. 6 in. Centres					
..	..	..	1 3	1 3	20, 000 plants	..	..	..
Tomato	Mar. to July	Aug. to Feb.	6 to 10 ft.	4 to 10 ft.	1 oz. seed per 2 000 plants	½	2½–3½	Grown in prepared-seed beds and transplanted. Plant spacing depends on variety and district
Turnip	Apr. to June	Mar. to June	2 6	0 6	2 lb.	½	1½–2½	..

Plate 85.

Sketch Map Showing Average Annual Rainfall. Each line connects districts with the same annual rainfall.

CHANGE OF ADDRESS.

Journal subscribers notifying change of address should state their full Christian names and surname as well as their full former and new addresses.

Address all communications to the Under Secretary, Department of Agriculture and Stock, Brisbane.

Seed Testing Explained.

F. B. COLEMAN (Standards Officer) and

A. C. PEEL (Technical Advisory Officer), Standards Branch.

THE Seeds Acts and regulations prescribe standards for purity and germination for agricultural and vegetable seeds offered for sale in Queensland. Any seed that does not comply with the appropriate standard is liable to seizure and destruction without compensation to the seller.

There is a penalty of £50 for an offence against the Acts.

The germination standard for certain selected seeds, and also lists of common prohibited and restricted weed seeds, are included in this article.

Many sellers of seeds, in an endeavour to ensure that the seeds which they are selling comply with the standards, submit samples to the seed testing section of the Standards Branch, Department of Agriculture and Stock, for examination and report.

It is undesirable for growers to buy and sow seed which will not germinate, and it is uneconomical as well as vexatious to sow seed which contains excessive amounts of weed seeds. Furthermore, death of stock can result from the eating of poisonous plants emanating from weed seeds sown with other seeds.

These and other facts relative to the quality of the seed available are worth knowing beforehand by the seller and the farmer. The facilities of the Brisbane Seed Testing Station are available for testing samples of seed. A fee of 2s. 6d. is charged for each sample tested if the bulk to which the sample refers is for sale, but, should a farmer desire to use the seed for his own sowing, no charge is made for the test.

The methods used in the Government Seed Testing Stations in Australia are those laid down by the "International Rules for Seed Testing" modified for Australian conditions. In some cases a period of three weeks may be necessary before it can be said with certainty whether a sample of seed will or will not grow.

For the information of those who desire to interest themselves in testing seeds, the following is supplied. Such tests would not be supported by authority in the case of a dispute, but valuable preliminary information can be obtained with a minimum of delay and used as a guide to possible future action.

One of the objects in testing seeds is to express on paper sufficient information about the sample examined to enable a value to be placed upon it or to compare it with other samples. The information should be clearly expressed to indicate the desirable, as well as the undesirable, features of the sample. This necessitates ascertaining the quantity

of prohibited seeds, weed seeds, other seeds and inert matter present, the presence of insects or injury due to insects and diseases, and lastly but by no means the least important, the ability of the seed to produce a healthy root and stem growth indicated in terms of germination in a given number of days.

Sampling the Bulk.

Unless the samples of seed submitted for testing truly represent the bulk to which they relate, subsequent work is of little value. Details of drawing samples are set out in a pamphlet entitled "Sale of Seeds" issued by this Department.

Upon receipt of a sample for testing, the marking on the sample and details as to its origin should be recorded in a book or on a card, and given a sequence number.

Working Sample.

The sample is placed upon a sheet of glass or stiff paper. Mix the seed thoroughly by means of a spatula, plasterer's knife or large knife blade, taking care the blade is inserted into the heap close to the glass, thereby lifting any small seeds, etc., before turning the blade over to form another heap. This should be continued until all the seed has been turned over at least three times. Avoid mixing with the fingers, as this allows small seeds and fine material to collect at the bottom of the heap. This fine material must be lifted up on the blade and mixed through the sample.

After mixing, spread out thinly and then, by the aid of the spatula or knife, lift several portions from different parts of the paper until a sufficient quantity is obtained, as indicated in the following:—

200 grammes beans and similar large seeds.
100 grammes cowpeas, cotton, pumpkin, wheat, etc.
30 grammes millets.
10 grammes grass seeds.
5 grammes Rhodes grass.
1 gramme paspalum.
(28.3495 grammes = 1 oz. Avoir.)

Analysis for Purity.

The analytical purity should be first ascertained in order that the germination may be carried out on the pure seed. Where the word "Purity" is used in seed testing, it relates to analytical purity—not purity of strain.

The weighed portion is spread out on a sheet of glass say 2 feet by 15 inches (see Plate 86)—stiff paper with a smooth surface will do—and, with the aid of a counter (a spatula-like instrument such as the blade of a table knife with one end pointed) it is divided into parts, as follows. Each of these parts should be weighed and calculations made on a percentage basis.

Plate 86.

Purity Test in Progress.

(*a*) *Pure seed—that is, the seed under consideration.*

All seeds of the kind under consideration, whether shrivelled, cracked or otherwise injured, and, in the case of broken seeds, any fragment larger than one-half, should be considered as pure seed. Pieces of seed that are one-half or less, and seeds of legumes (lucerne, cowpeas, clovers, peas, beans, &c.) with the seed coat absent, should be considered as inert matter.

Grass seeds which consist of a caryopsis enclosed in glumes, or naked caryopses (hulled seeds), should be considered as "pure seed". The presence or absence of a caryopsis within the glumes may be determined by testing each grain very carefully with a pair of forceps or by means of the fingernail, without injuring the germ, or by stroking the seed with a thin-bladed scalpel or sharpened spatula of horn or similar material. Care must be taken not to injure the caryopsis by undue pressure.

When in samples of grass seeds with many-flowered spikelets several individual seeds adhere together, these should be separated, and all parts of the spikelet which normally do not belong to the seed in question should be removed and treated as "inert matter". However, with some grasses (for example, Rhodes grass, *Chloris gayana*), where the separation of the sterile glumes would involve an excessive amount of work, this procedure may be omitted.

(*b*) *Seeds of other crop plants.*

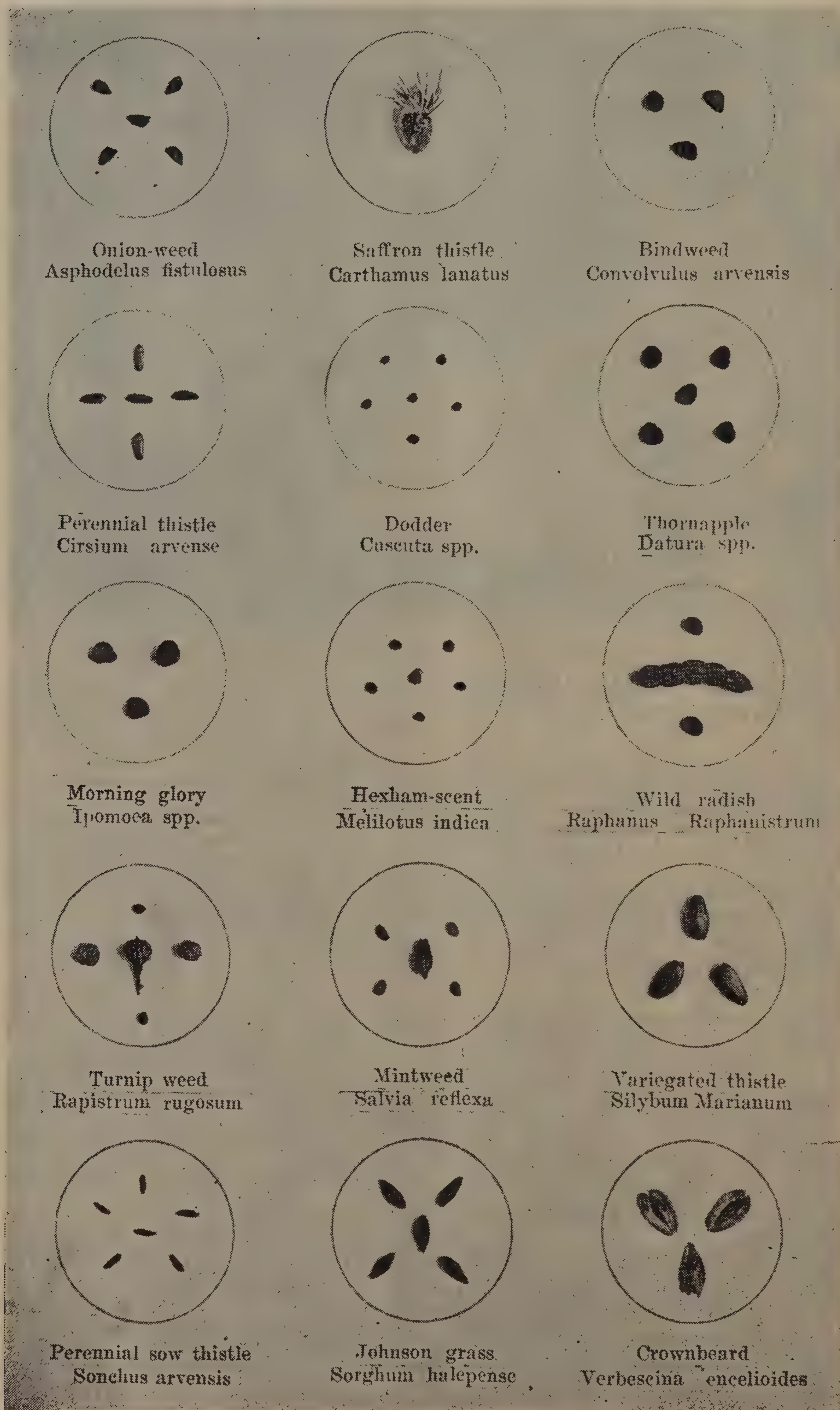

Plate 87.

Prohibited Seeds.

(*c*) *Prohibited seeds.*

The principal totally prohibited seeds commonly found in Queensland include the following and are shown in Plate 87:—

Asphodelus fistulosus	Onion weed
Carthamus lanatus	Saffron thistle
Convolvulus arvensis	Bindweed
Cirsium arvense: Syn. *Cnicus arvensis*, Syn. *Carduus arvensis*	Creeping Californian thistle or Perennial thistle
Cuscuta spp.	Dodder
Datura spp.	Thornapple, Datura
Ipomoea spp.	Morning glory, Bell vine
Melilotus indica	King Island Melilot, Hexham scent
Raphanus raphanistrum	Wild radish, Jointed charlock
Rapistrum rugosum	Turnip weed
Salvia reflexa	Mintweed
Silybum marianum: Syn. *Carduus marianus*	Variegated thistle
Sonchus arvensis	Perennial sow thistle
Sorghum halepense	Johnson grass
Verbescina encelioides	Crownbeard

Seeds infested with live insect pests in any stage of development and diseased seeds are also prohibited.

All recognised cultivated varieties of the above-mentioned species used for the purpose of cultivation are exempt from this list.

(*d*) *Weed seeds.*

After recording the total weight of all weed seeds, they are identified and divided into two groups called, respectively, restricted and others.

In the case of barley, beans, cowpeas, maize, oats, peas, rye, tares, wheat and seeds of similar or larger size, the number of restricted weed seeds hereunder mentioned present in 1 lb. should be determined. In the case of other seeds, the number of restricted seeds per ounce should be ascertained.

The restricted weed seeds (Plate 88) which occur most frequently in Queensland are:—

	No. of seeds in oz. or lb.
Alternanthera repens—Khaki weed	20
Argemone mexicana—Mexican poppy	10
Brassica spp.—All weed species	20
Cirsium lanceolatum—Spear thistle	10
Echium spp.—Bugloss	20
Lithospermum arvense—Corn gromwell or Ironweed	20
Marrubium vulgare—Horehound	10
Polygonum spp.—Wireweed	20
Sisymbrium spp.—Mustard weed, Wild mustard	20

(*e*) *Inert matter—that is, any matter that is not a seed as indicated above.*

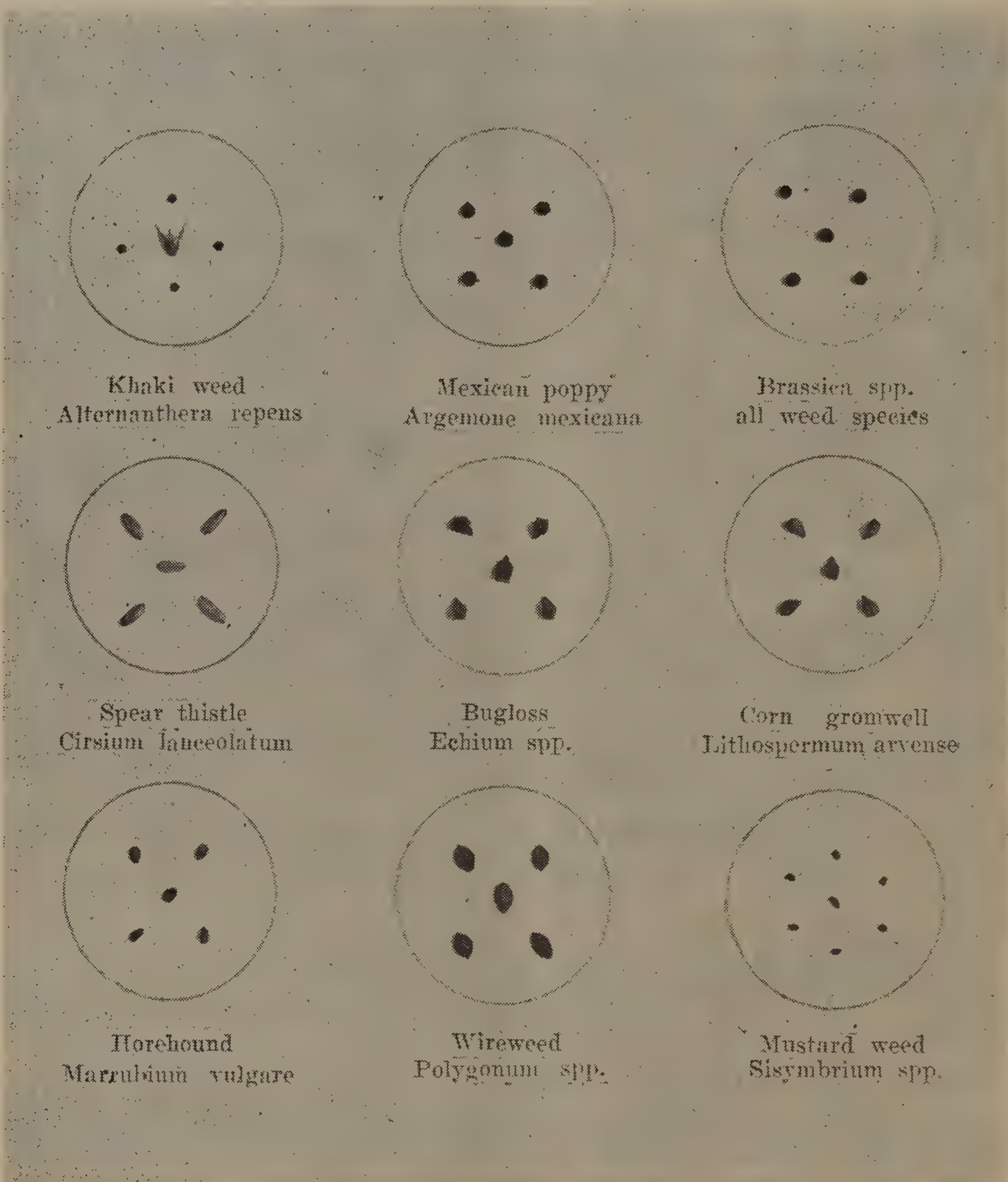

Plate 88.

Restricted Seeds.

Seeds of half or less than half in size are considered as inert matter. Inert matter includes all empty or sterile glumes—that is, glumes without caryopses, except in the case of—

Rhodes grass,

Molasses grass,

Guinea grass,

Green panic grass,

Panicum muticum,

in which case all of the so-called commercial seeds, with or without caryopses, should be included in the "pure seeds".

Germination.

The pure seed is placed out to germinate as follows:—

Take three lots of 100 seeds (that is, pure seed) and space evenly onto three thicknesses of moist flannelette or onto a bed of sand of not less than half an inch in depth which has been first placed on a clean plate or tin tray, and keep moist. Excessive amounts of water are detrimental in particular for marrow, pumpkin and rockmelon. Sand used for this purpose should be clean and obtained from a source not contaminated with salt or brackish water. It should be boiled before use so as to reduce contamination. In the case of small seed such as lettuce, cabbage, carrot, &c., squares of filter paper, marked in 100 sections, can be placed on the moist flannelette or sand, one seed being placed in each section. For reference purposes, the test should bear the sample number and each hundred seeds should receive the letters A, B, and C respectively. It is best to keep a sheet of glass or other material on top of the plate or tray so as to prevent excessive evaporation. Large seeds such as peas, beans, cowpeas, marrow and pumpkin require to be covered with flannelette. Care should be taken to place the trays in a position suitable for the germination of the seeds concerned. For instance, winter grasses, winter-growing crops, &c., should be placed in as cool a position as possible during warm or hot weather, while summer grasses and summer-growing crops should be placed in a warmer position.

Plate 89.

Seed Germinators run at Different Temperatures and a Refrigerator used for Pre-chilling Seed.

In actual practice, germinators operating at controlled temperatures such as 68°F., 78°F., 86°F., 90°F., and 99°F., and for pre-drying at a temperature of 104°F., are used (Plate 89). For some seeds alternating temperatures are required. Obviously these conditions are only available in properly equipped seed-testing stations.

The following table sets out temperatures most suited for the germination of some of the more common seeds:—

Kind of Seed.	Temperature.	Minimum Germination.
	°F.	%
Barley	68	80
Beans (French)	78	75
Beet	78	55*
Cabbage	68	65
Canary seed	68	65
Carrot	78	50
Couch grass	68 and 99 (*a*)	60
Cowpeas	90	70
French millet	78	75
Japanese millet	78	75
Lucerne	68	80
Maize	78	80
Mauritius beans	90	70
Millets	78	75
Molasses grass	68 and 99 (*a*)	30
Oats	68	80
Onion	68	50
Panicum	78	75
Parsnip	68	40
Paspalum	68 and 99 (*a*)	60
Peanuts	78	80
Peas	68	75
Phalaris tuberosa	68	60
Prairie grass	68	65
Radish	78	75
Rhodes grass	90	30
Rye corn	68	75
Sorghum	90	70
Sudan grass	90	65
Tomatoes	78	70
Wheat	68	80
White panicum	90	75

* Clusters.

(*a*) Alternating temperature—lower temperature at night, higher temperature by day.

Plate 90.

Germination Count in Operation. A seed analyst is counting while the other analyst records results.

Note the number of seeds that germinate from day to day and record results (see Plate 90). Take careful note that only those seeds are counted that produce strong, healthy development.

When counting legume seeds such as lucerne, cowpeas, clovers and Mauritius beans, a number of sound seeds may be found that have not germinated; these are known as hard seeds. They may germinate at a later date, but if the seed coat is scratched, permitting the entrance of moisture, germination will commence immediately.

In the case of maize, wheat, oats, barley, all grasses and other seeds of the order *Gramineae* (grass family), only those producing root and stem growth are counted as germinating. Sowing some of the larger seeds in the soil will act as a check for the results obtained in the above manner. All germinated seeds should be removed from the tray or plate when counted and the number entered on a sheet of paper ruled as follows:—

Sample No. ....

Date Started.	No. of Seeds.	Germination in Days.									Total Germination %
			1	2	3	4	5				
		A									
		B									
		C									

From these records, particulars regarding speed and uniformity of germination, in addition to total germination percentages, may be obtained.

The percentage of pure germinating seed—which is a true indication of the value of a seed sample—is based on purity and germination and is obtained by the following formula:—

$$\frac{\text{Pure Seed \% x Germination \%}}{100} = \text{\% Pure germinating seed.}$$

Little difficulty is likely to be encountered with seeds such as wheat, maize and beans, provided they are fully matured, but with a number of seeds such as Rhodes grass, paspalum, &c., owing to the experience and technique necessary, and also the special apparatus and equipment required, it is not possible to obtain accurate results without such facilities.

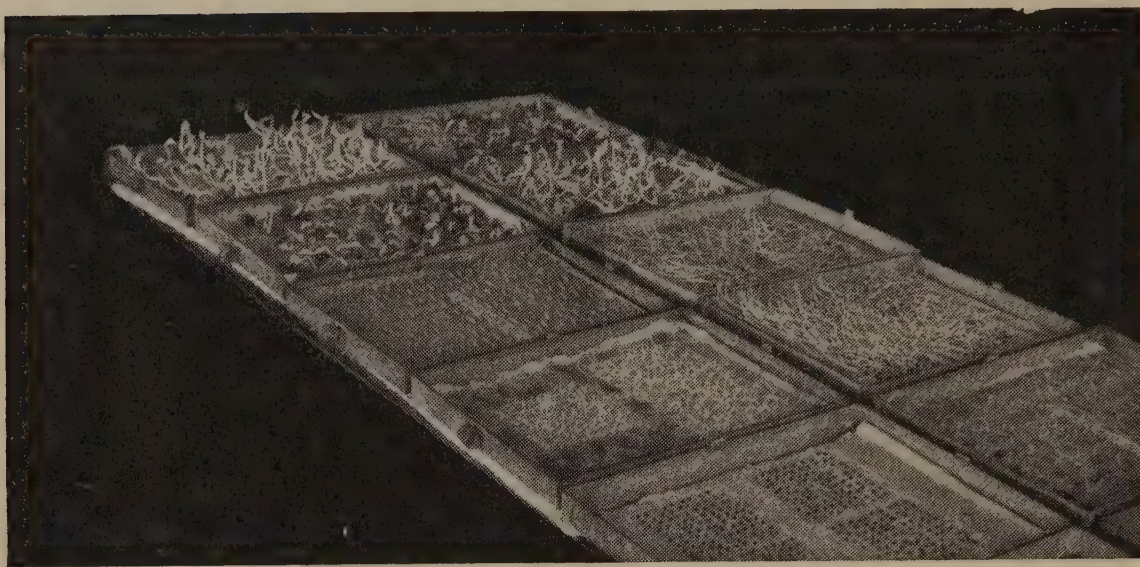

Plate 91.

Seeds Germinating on Trays. The glass covers have been removed in readiness for counting.

Plate 91 shows a series of seeds on the germinating trays; some of them have not yet commenced to germinate, while others are well advanced, as can be seen by the profuse root and stem growth.

Seed Testing Equipment.

Some of the equipment required is as follows:—

1 sheet of glass, galvanised iron or thick paper—24 inches x 14 inches.

1 plasterer's spatula with 11-inch blade.

1 metal seed counter.

1 pair medium-ended forceps.

1 lens, magnification x 5.

4 Petri dishes or round glass dishes with lids.

1 small scoop.

1 balance.

1 set weights, gramme preferred.

Germination trays of galvanised iron, aluminium or other suitable metal—10½ inches x 8 inches.

Glass sheets for covering germination trays.

Flannelette or supply of clean sand for making seed-bed.

1 squeegee for rolling out flannelette for removal of air pockets and excess moisture.

Filter paper squares marked with 100 small squares.

Filter paper strips for marking sample number.

1 waterproof pencil.

1 scribbling block for calculations.

1 black lead pencil.

Seed envelopes—2 sizes.

Book or cards for recording findings.

ANIMAL HEALTH

Bracken Fern Poisoning of Cattle.

K. D. SKERMAN (Government Veterinary Officer) and L. G. NEWTON
(Officer-in-Charge, Animal Health Station, Oonoonba, Townsville).

FOR many years sporadic deaths of cattle showing the characteristic effects of bracken fern poisoning have been recognised in this State, but it has often been difficult to convince owners that the plant can be harmful to stock.

As early as 1893 it was believed in other parts of the world that an acute, fatal sickness of cattle could be caused by their eating bracken; soon after that time feeding tests with chopped plant showed that a similar condition could be reproduced experimentally. Since then, tests have been done on numerous occasions by different investigators; some of their results are tabulated:—

Animal.	Age.	Bracken Consumed.	Period.	Result.
		Lb.	Days.	
Calf	3½ months	112	30	Died
Calf	8 months..	260	26	Died
Heifer	18 months ..	915	74	Died
Heifer	18 months ..	678	78	Lived
Heifer	3 years ..	578	262	Lived

In a recent trial in the Atherton district, two 14-months old steers were fed bracken fern. One of the animals died suddenly with typical bracken poisoning after 69 days, having eaten 214 lb. of the plant. The other showed signs of illness but recovered, bracken feeding being discontinued when symptoms appeared.

While feeding tests have not always caused death, they show conclusively that bracken is poisonous.

Description of the Plant.

Bracken (*Pteridium aquilinum*) is widely distributed in temperate and tropical regions of the world. Many varieties have been described. During the course of feeding tests at Atherton, two varieties—common bracken and hairy bracken (var. *lanuginosum*)—were identified.

Common bracken is a coarse robust fern with creeping underground stems often covering extensive areas of country. Fronds (Plate 92) are erect, mostly 2-3 feet high and 1-2 feet across but varying considerably in size according to the situation and locality. Spores are borne on the undersurface of the fern in long narrow lines close to the margins of the lobes of the frond.

Plate 92.
A Mature Frond of Bracken Fern.

Hairy bracken, which appears to be restricted to tropical areas, reaches a height of up to six feet. It has hairy stems and retains a soft growing point at the top of the mature stem.

Bracken can become a serious pest of pasture lands and thrives well where paddocks are overstocked and overgrazed. It is under these conditions that mortalities are most likely to occur.

Stock Affected.

Deaths occur most frequently in calves about yearling age, though adult animals may also be affected and in certain instances losses have been confined almost entirely to the older cattle (for example, breeding cows).

On some farms losses occur every year but as a rule they tend to be sporadic. In North Queensland, deaths occur most frequently in spring and autumn.

Horses are affected with ''bracken staggers'' in other countries but the disease has not been seen in this State. Recent reports from overseas also indicate that sheep may die of bracken poisoning, but it is unlikely that similar mortalities will occur here as sheep are not usually kept in coastal areas where bracken is prevalent.

Course of the Disease.

Bracken poisoning is essentially a slow process, and large amounts of the plant must be eaten to produce toxic effects. An important feature is that deaths often continue for some weeks after animals have been removed from bracken infested areas. The duration of illness is usually short, about three days, and once symptoms are manifest death is the usual result. Should recovery occur, the animal may remain dull and in low condition for some months.

Symptoms.

In many cases death occurs suddenly without symptoms being shown. The usual manifestations include dullness, lack of appetite, and a high temperature. The coat is harsh and staring and condition falls away rapidly. Dark, hard, foul smelling dung which often contains clots of blood is passed; in the later stages it may consist almost entirely of blood.

A common feature is bleeding from natural openings (nostrils, anus, vagina and the eyes), and not uncommonly through the skin, though there is no sign of injury or bruising. At times blood accumulates in and about the loose tissues of the throat, causing difficulty in breathing. In these cases the head is held low and in the later stages the mouth is opened to assist breathing. This form of the disease is sometimes referred to as the "laryngeal" type. Dark-brown urine is seen in some cases. Struggling and bellowing often precede death.

Post-mortem Findings.

The most spectacular and characteristic changes are seen after death. The most pronounced abnormality is haemorrhage (bleeding) into and about the tissues of any part of the body. When the skin is removed, haemorrhages varying in size from a pin head to broad sheets several inches in diameter may be seen; clots of blood may be present where the skin is loose, such as the brisket, the throat and behind the shoulder.

On opening the abdomen, large haemorrhagic areas varying from an inch to a foot across are frequently seen on the outer surface of the paunch and intestines. The interiors of the first three stomachs (honeycomb, paunch and bible) are usually normal but in the fourth or true stomach, two types of change occur: in some cases the folds of the lining membrane are greatly swollen and distended with fluid (oedema) while in others they are of normal size but punctured with numerous shallow ulcers.

Free blood or bloodstained food material may be found in any part of the intestine, and the walls are intensely reddened; large clots of blood are especially likely at the lower end of the small bowel and caecum (blind gut). Brownish or red striping of the internal lining of the caecum, referred to as "zebra marking," is often seen.

Changes in the liver vary, there being little departure from normal in many cases while in others there are greyish patches scattered throughout its substance or a brownish-yellow discoloration over the whole organ.

Haemorrhages are constantly present in the heart. They frequently form a pattern with numerous pin-head sized spots in the fatty tissue and along the grooves, but in other cases "splashes" of blood extend over most of the heart muscle and clots are found inside the organ.

Bleeding takes place into the lung tissue, giving localised areas of congestion or large clots which lead to the development of pneumonia.

Plate 93.

Stomach of Calf Showing Lining Membrane with Thickened Folds Typical of Bracken Poisoning.

Diagnosis.

The diagnosis of bracken poisoning is based on the following:—

(1) Bleeding from the nostrils, anus, or through the skin.

(2) The passage of hard, black dung containing blood.

(3) High temperature—up to 107 deg.

(4) Shallow ulcers inside the lips and in the nostrils (sometimes red haemorrhagic spots are seen in the nostrils).

(5) Haemorrhages throughout the tissues.

(6) Oedema or ulceration of the folds of the fourth stomach (abomasum).

(7) Blood or bloodstained material in the bowel.

Toxic Effects and How They Are Produced.

Much of the confusion regarding the toxicity of bracken has arisen because it was not understood how the plant produced its toxic effects.

The harmful results of poisonous plants are usually due to the presence of a toxic principle—for example, prussic acid (in some sorghums) alkaloids (in ironwood), and nitrates (in wild mint). These substances interfere *directly* with one or more of the normal functions of the body. Bracken, on the other hand, is believed to act *indirectly* by destroying vitamin B, so the animal actually suffers from a vitamin deficiency disease.

American workers first showed that when rats were fed on a diet containing bracken fern they developed symptoms identical with vitamin B1 (thiamin) deficiency. Furthermore, the rats recovered quickly when treated with this vitamin. Soon afterwards, in Wales, it was found that horses with "bracken staggers" responded equally well to treatment with thiamin. Finally, it was demonstrated by test tube experiments that certain "extracts" of bracken leaves have the power to destroy vitamin B1.

With cattle the position is still not entirely clear. Though these animals, when affected with bracken poisoning, show a deficiency of vitamin B1, as determined by chemical tests, they do not respond to treatment with this vitamin. Recent reports from England, however indicate that another member of the vitamin B group (nicotinic acid) is effective in treating the disease. As the various members of the vitamin B group act in conjunction, further information is required to determine exactly how the toxic effects of the plant are produced in cattle.

Treatment and Control.

Treatment has been of little value up to the present but vitamin B therapy appears promising. However, death often occurs so suddenly that treatment, no matter how efficacious, cannot be used. Every effort should therefore be directed towards preventing bracken being eaten in sufficient quantities to be harmful. The following procedures are recommended:—

(1) Avoid overstocking and depleting the pasture—these conditions favour the growth of bracken, and the amount of bracken eaten will also be greater.

(2) Calves about yearling age and breeding cows are most prone to be affected. Feeding bonemeal mixtures will help to prevent deficiency of minerals which may lead to depraved appetite and hence eating larger quantities of bracken than usual.

(3) As the disease has a seasonal incidence, ensure that calves are supplied with the best possible feed during the most dangerous periods (spring and autumn).

(4) Reduce bracken undergrowth by rotation and pasture management.

(5) If the eradication of bracken is considered, consult agricultural officers of the Department of Agriculture and Stock before undertaking the work, as incorrect methods may lead to increased growth rather than successful control of the plant.

Graphs and the Woolgrower.

R. E. CHAPMAN, Wool Technologist, Sheep and Wool Branch.

IN his excellent book, *Mathematician's Delight,* W. W. Sawyer points out that people often regard mathematics, or anything verging on mathematics, as something to be feared and dreaded. But why, he asks, should there be such fear? Does it lie in the nature of the subject itself?

Quite certainly the cause does not lie in the nature of the subject. The most convincing proof of this is the fact that people in their everyday occupations (when they are making something) do reason along lines which are essentially the same as those used in mathematics. However, they are unconscious of this fact, and would be appalled if anyone suggested that they should interest themselves in mathematics for everyday use.

The fear of this subject is a tradition handed down from days when the majority of teachers knew little about human nature, and nothing at all about the nature of mathematics itself. What they taught was an imitation.

Nearly every subject has an imitation, but as such it is merely parrot-learning. It is this which produces the schoolboy "howlers" in examination papers, because the words do not convey any picture and there is a lack of realistic thinking. Real education makes "howlers" impossible, but more important is the saving of unnecessary strain, and the achievement of security and confidence of mind. It is far easier to learn the real subject properly than to learn the imitation badly.

To understand anything requires effort; but it does not necessarily require unpleasant effort or drudgery. The main task is to see the practical applications of the subject.

While text-books are needed to master any special department of mathematics, most of them contain vast masses of information, the object of which is not always obvious. It would be useless to burden one's memory with all this purposeless information when merely trying to understand a subject. Mathematics is like a chest of tools: before studying the tools in detail a good workman should know the object of each, when it is used, how it is used, and for what purpose it is used.

Graphs—or Thinking in Pictures.

One problem in the presentation of facts is to make them obvious. A bald statement is soon forgotten, whereas vivid images remain in the memory. In this respect graphs are a valuable aid in presenting data.

What is a graph? In its simplest form a graph is a pictorial representation of the relation that exists between two variable quantities, and shows the manner in which one changes as the other alters in value. For instance, the weight of a sheep depends, among other things, on its age, in which case age is termed the independent variable and weight the dependent variable. In drawing a graph, intervals of age (the independent quantity) are marked off along a horizontal scale, and intervals of weight (the dependent variable) along a vertical scale. The actual line or graph is obtained by joining the points which represent the weights at various ages. To mark these points, indicated by crosses in Figure 1, vertical lines are drawn from the various ages on the horizontal scale to meet horizontal lines through the corresponding weights on the vertical scale. These are shown by the dotted lines in the figure. The graph is then drawn through the points of intersection of these vertical and horizontal lines. A somewhat similar procedure is followed when the weight at a certain age is being read from the graph. A vertical line is drawn at the required age until it cuts the graph, from which point a horizontal line is drawn to the left-hand scale, from which the weight is read.

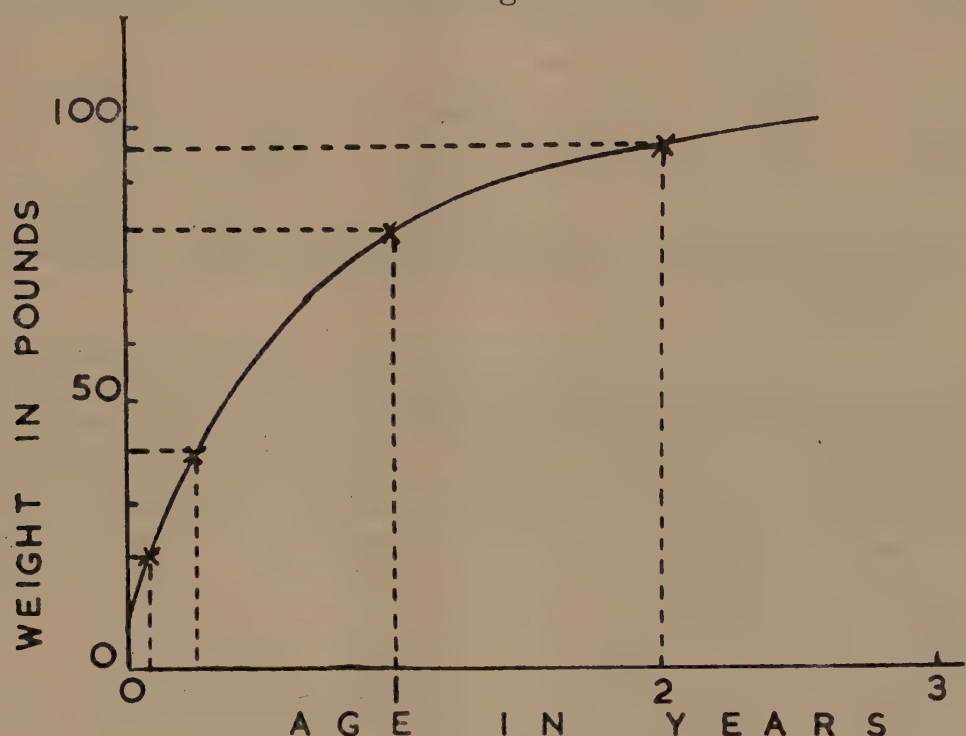

Figure 1.

Graph Showing the Increase in Liveweight of a Sheep with Age. The vertical scale shows the liveweight of the sheep in pounds and the horizontal scale its age in years. The sheep concerned weighed 20 lb. at the age of 1 month, 40 lb. at 3 months, 80 lb. at 1 year and 98 lb. at 2 years. The broken lines are not part of the graph: they have been drawn to show how the points of the graph are marked.

This brings up the question of scales. Generally, the horizontal and vertical lines are marked off in intervals which represent a certain quantity. For example, in Figure 1, one inch on the horizontal line represents one year of age, and one inch on the vertical line is

equivalent to 50 lb. of liveweight. The intervals used depend on the nature of the relationship, the magnitude of the quantities involved, and the size of the graph required.

In the case of a graph of the sheep population of Queensland over the last 60 years, the quantities are of considerable magnitude, the sheep population being in millions. If years are marked along the horizontal scale and sheep numbers along the vertical scale, then less than one inch on the vertical scale will have to represent several millions of sheep, as shown in Figure 2.

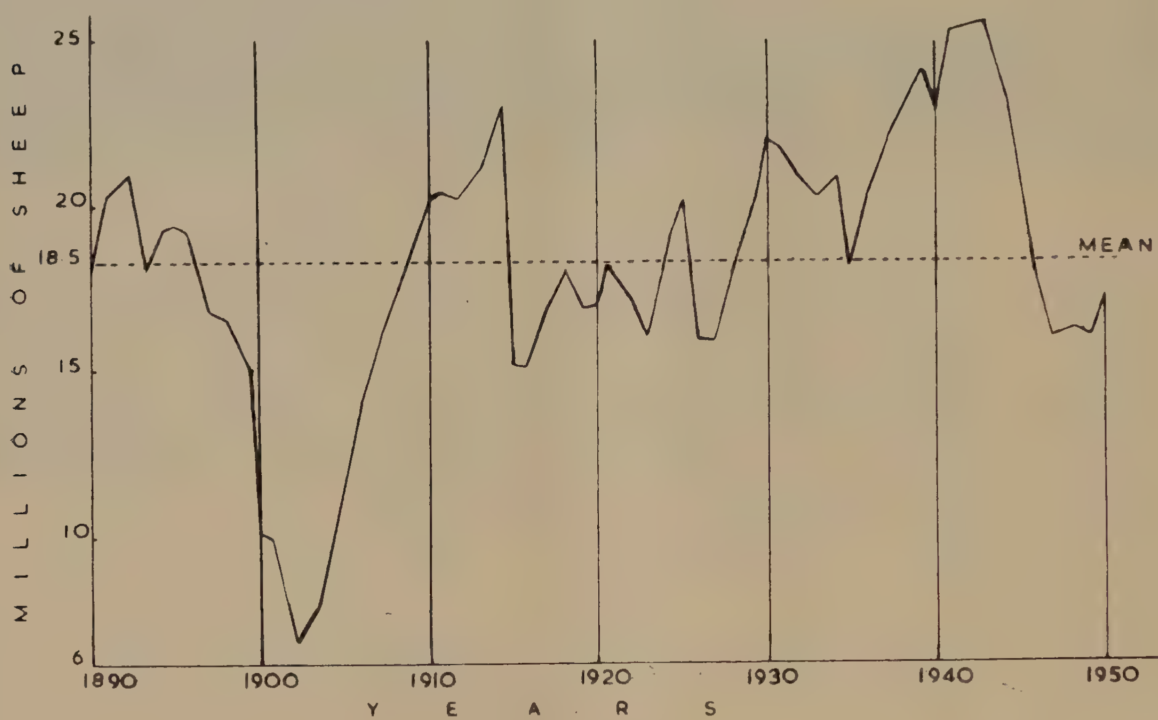

Figure 2.

Graph of Queensland's Sheep Population for the Period 1890-1950. Here $\frac{5}{8}$ inch on the horizontal scale represents 10 years, and $\frac{5}{8}$ inch on the vertical scale 5 million sheep.

As a result of the diversity of information that can be recorded graphically, there are no set scales for use in practice, and those used depend entirely on the choice of the person who draws the graph.

Figure 2 is useful to show the variations about the average which have occurred in Queensland's sheep population. It also shows the extent of the fluctuations and the number of years in which the population has been above or below the average (mean).

Figures 1 and 2 represent two different types of graph, one being a fairly smooth curve, and the other a series of steps. The form of the graph is decided by the nature of the relationship which the graph is intended to illustrate.

One important point that must be kept in mind when reading graphs is the necessity of noting the scales that are used, otherwise a somewhat misleading idea may be obtained. For instance, a casual glance at the top graph in Figure 3, which shows the changes in greasy cut per head for different age groups of wet ewes, would suggest an alarming fall in greasy fleece weight after the sheep is 3 years old. However, on closer examination it is seen that each vertical interval represents only half a pound change in cut per head, and had a smaller distance been used to represent this, the graph would have appeared much flatter, as in the lower graph.

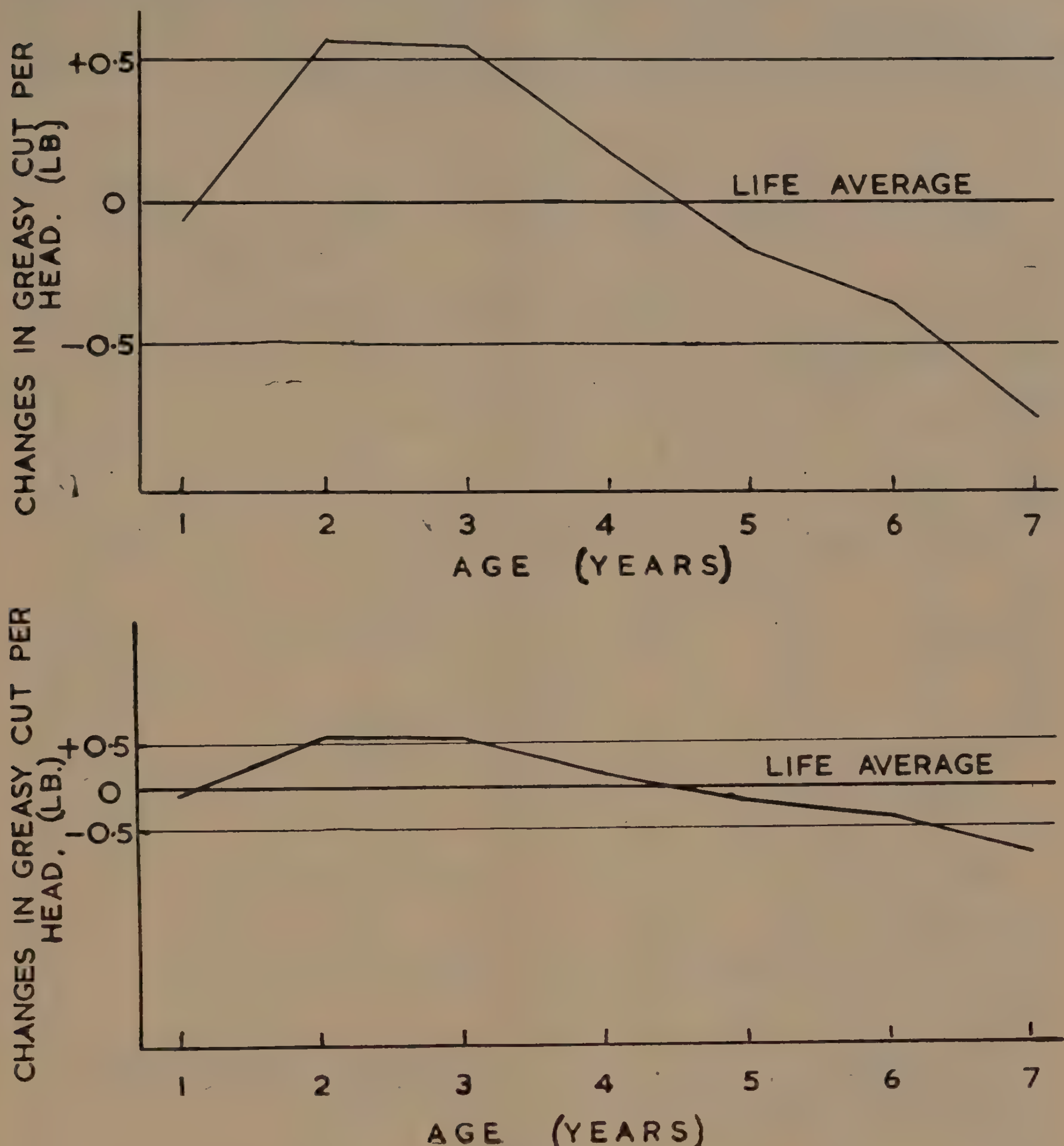

Figure 3.

Graphs Showing Changes in Greasy Cut Per Head with Age. The graphs are prepared from the same set of figures, but a smaller vertical scale is used in the lower graph, making the changes appear smaller. The point 0 on the vertical scale in both cases represents the average cut per head over the lifetime of the sheep; the point —0.5 represents a cut of half a pound below the lifetime average; the point +0.5 represents a cut of half a pound above the lifetime average. The horizontal scale presents the age in years.

The graph shows that the cut is above the lifetime average during the earlier years of life but falls below the average after the sheep reaches 4½ years of age.

By using the large interval, the differences between age groups can be more readily measured from the graph. Quite often where small quantities are involved it is necessary to use an exaggerated scale to show up the differences.

Graphs with Three Variables.

So far the cases considered have involved only two variables, and their relationship has been one line, either continuous or stepped. It is also possible, however, to represent the relation between three variables graphically. The horizontal and vertical scales are used as before for two of the variables, and the third is brought into the picture by using a series of lines instead of only one.

An example of this is seen in Figure 4, which shows possible culling rates of ewes, the three variables being lamb-marking percentage, culling percentage and number of breeding seasons.

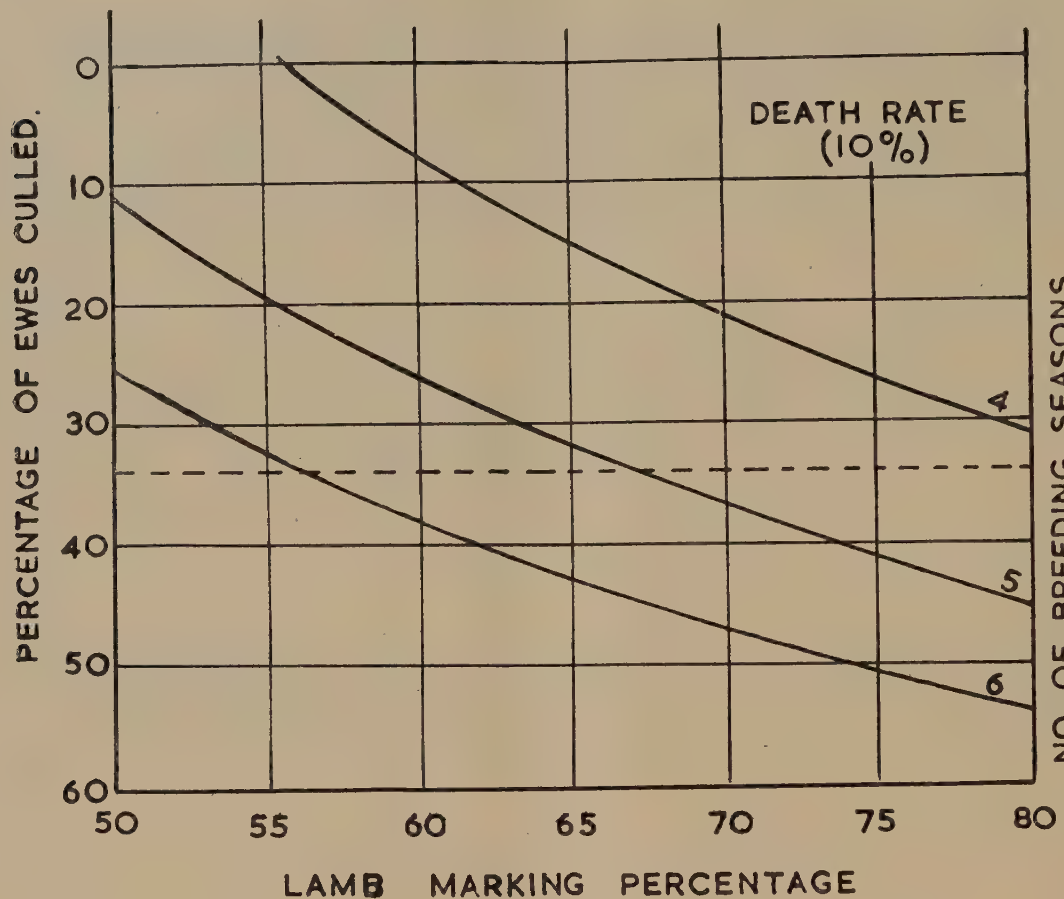

Figure 4.

Graph Showing Culling Rates Needed to Maintain Flock Numbers for Various Lamb-marking Percentages and Various Numbers of Breeding Seasons. The left-hand vertical scale shows the percentage of young sheep that can be culled and the horizontal scale the lamb-marking percentages. In practice, the proportion of young sheep which can be culled depends on (1) the lamb-marking percentage, (2) the losses the flock experiences, and (3) the number of times the ewes are mated. The graph has been drawn for an average annual loss of 10% and the number of times the ewes are bred is shown by the curved lines marked 4, 5 and 6 on the right-hand vertical scale.

The dotted line represents a culling rate of 34%, at which flock strength will be maintained if (1) the ewes are bred 6 times and the average lamb-marking percentage is 57, (2) if the ewes are bred 5 times in a flock which has an average lamb-marking percentage of 67, or (3) if the ewes are bred four seasons, when the average lamb-marking percentage would need to be about 82.

As the number of breeding seasons is changed there is a new curve for the relation between the percentage of ewes culled and percentage of lambs marked, but for convenience these are all drawn on the one graph.

Histograms.

Graphs, whether as continuous curves or as a series of steps, are by no means the only method of pictorial presentation of data. A near-relation of the graph is what is called a histogram, examples of which are shown in Figures 5 and 6. Rectangles with their heights corresponding with the appropriate number of units on the left-hand vertical line are erected over each division of the horizontal line.

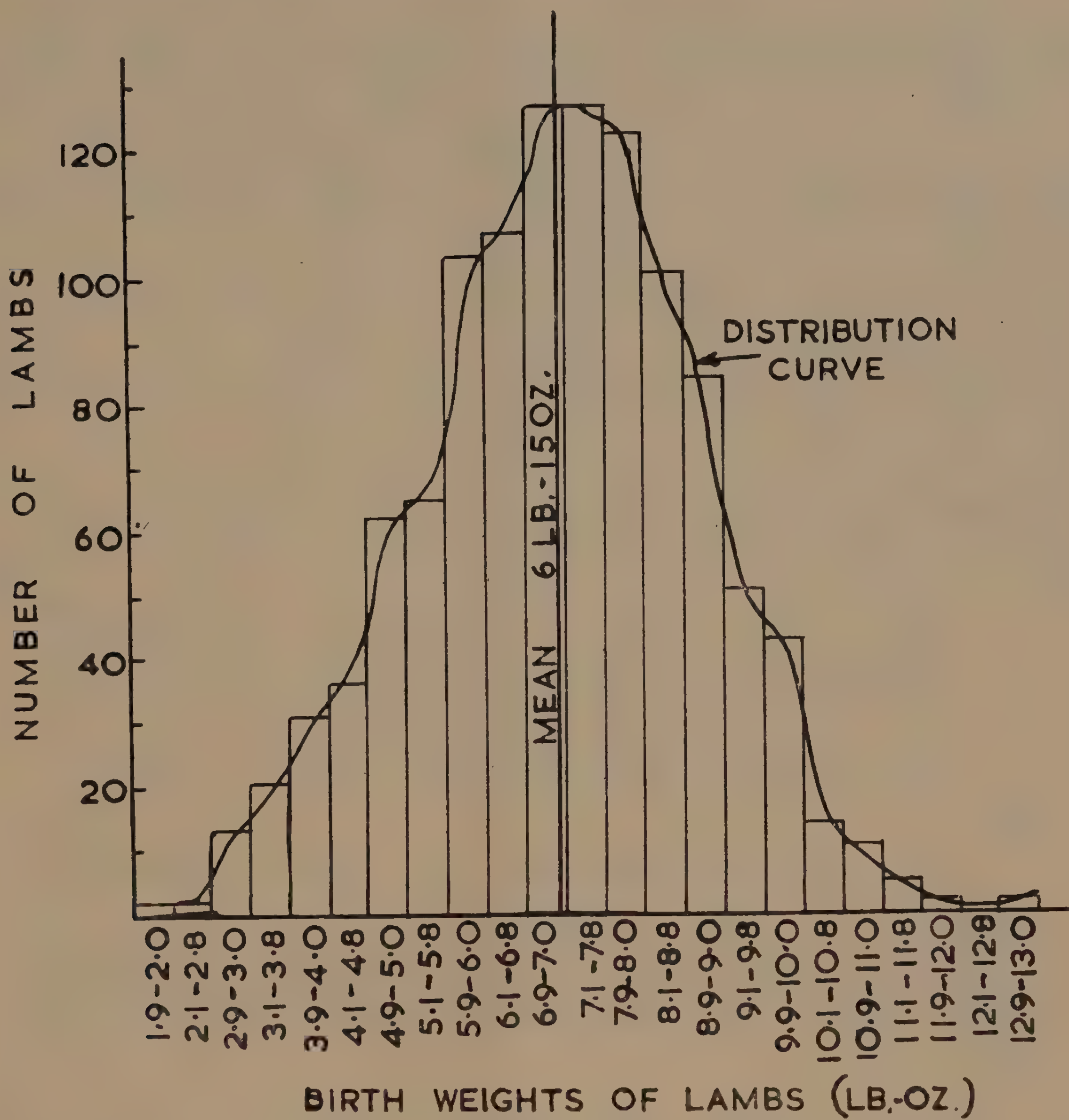

Figure 5.

Histogram of Birth Weights of Lambs to Ewes with Sound Udders. This histogram and the one that follows have been drawn from results of studies in losses amongst new-born lambs in Queensland. Altogether over 2,000 lambs were weighed at birth in these observations. The vertical scale in this histogram represents the number of lambs born to ewes with sound udders and the horizontal scale the birth weight of the lambs in pounds and ounces. It is seen that the birth weights range from 1 lb. 9 oz. to 13 lb. and these are divided into groups arranged in half-pound intervals.

Of the lambs born to ewes with sound udders—

2 lambs weighed between 1 lb. 9 oz. and 2 lb.

2 lambs weighed between 2 lb. 1 oz. and 2 lb. 8 oz.;

13 lambs weighed between 2 lb. 9 oz. and 3 lb.;

21 lambs weighed between 3 lb. 1 oz. and 3 lb. 8 oz.;

and so on, up to

2 lambs weighed between 12 lb. 9 oz. and 13 lb. 0 oz.

In drawing Figure 5, rectangles were erected in each age group on the horizontal line with their heights proportional to the number of lambs in each group.

It will be noticed that a line can be drawn through the tops of the rectangles: this is the distribution curve. In Figures 5 and 6 the curves are the distribution curves of the number of lambs plotted against birth weights. The curve in Figure 5 is fairly evenly distributed on each side of the mean and hence is termed a *normal* distribution curve.

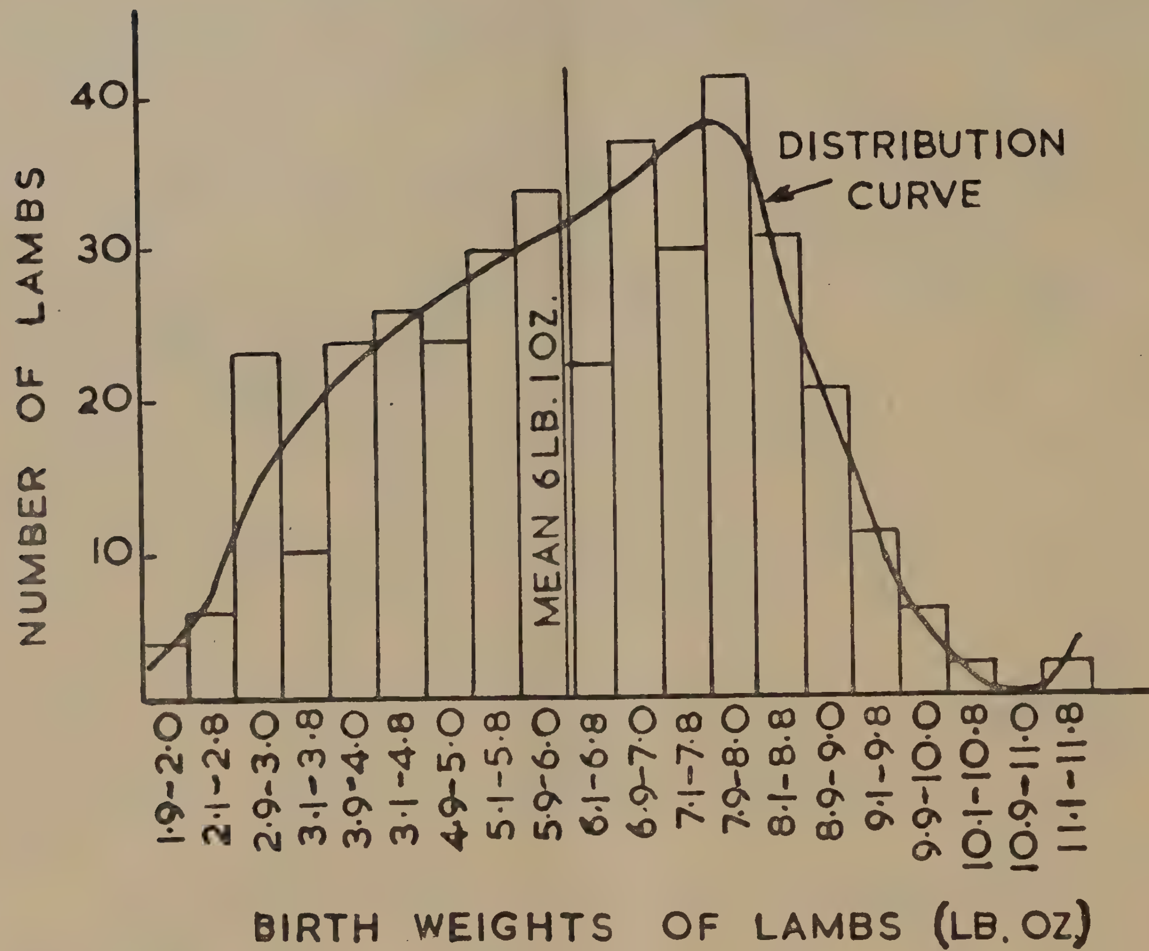

Figure 6.

Histogram of Birth Weights of Lambs Born to Ewes with Unsound Udders. The curved line shows that the birth weights are not symmetrical about the vertical line labelled "mean" which passes through the average birth weight of all the lambs.

Quite often, however, a distribution curve is not symmetrical about the mean or average, in which case it is known as a *skew* distribution. Figure 6 illustrates this type of distribution. It was constructed similarly to the previous one except that the lambs whose birth weights are presented were selected from ewes with unsound udders.

The advantage of the histogram is that it shows the manner in which the measurements (in the cases quoted, the numbers of lambs of different birth weights) are distributed throughout the whole range.

The Uses of Graphs.

Graphs have a great advantage over tables of figures when information has to be examined at a glance. It is quite easy when running an eye down a row of figures to fail to see that one number is much larger than the rest. On a graph such a number would stand out like a mountain peak. A sudden bend in a graph is easily seen whereas a casual glance at the corresponding figures would not as readily reveal its existence. Graphs are particularly useful for busy men who want to know the general outlines of a situation, but do not wish to go into every small detail. In a few seconds one could grasp the general outline of a graph sufficiently well to be able to reproduce it later with fair accuracy, if required, whereas a column of figures would still convey little after much longer study. Further, graphs are a convenient method of summarising data in a condensed form.

Consider, for instance, the number of times that rain sufficient to stimulate plant growth has fallen in each month at Winton, Tambo and Goondiwindi during the years 1893-1948. These are shown in Table 1.

TABLE 1.

SHOWING THE NUMBER OF TIMES IN 55 YEARS THAT RAIN SUFFICIENT TO STIMULATE PLANT GROWTH HAS FALLEN IN EACH MONTH AT WINTON, TAMBO, AND GOONDIWINDI.

Station.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.
Winton ..	3	8	12	26	34	19	5	10	11	14	1	3
Tambo ..	15	21	31	37	37	28	16	17	33	25	12	13
Goondiwindi	26	31	38	37	30	29	25	33	41	43	29	29

It is not easy to obtain a general picture for these three centres by studying this set of figures, whereas the graph in Figure 7 drawn from these figures shows quite clearly the variations at each of these centres.

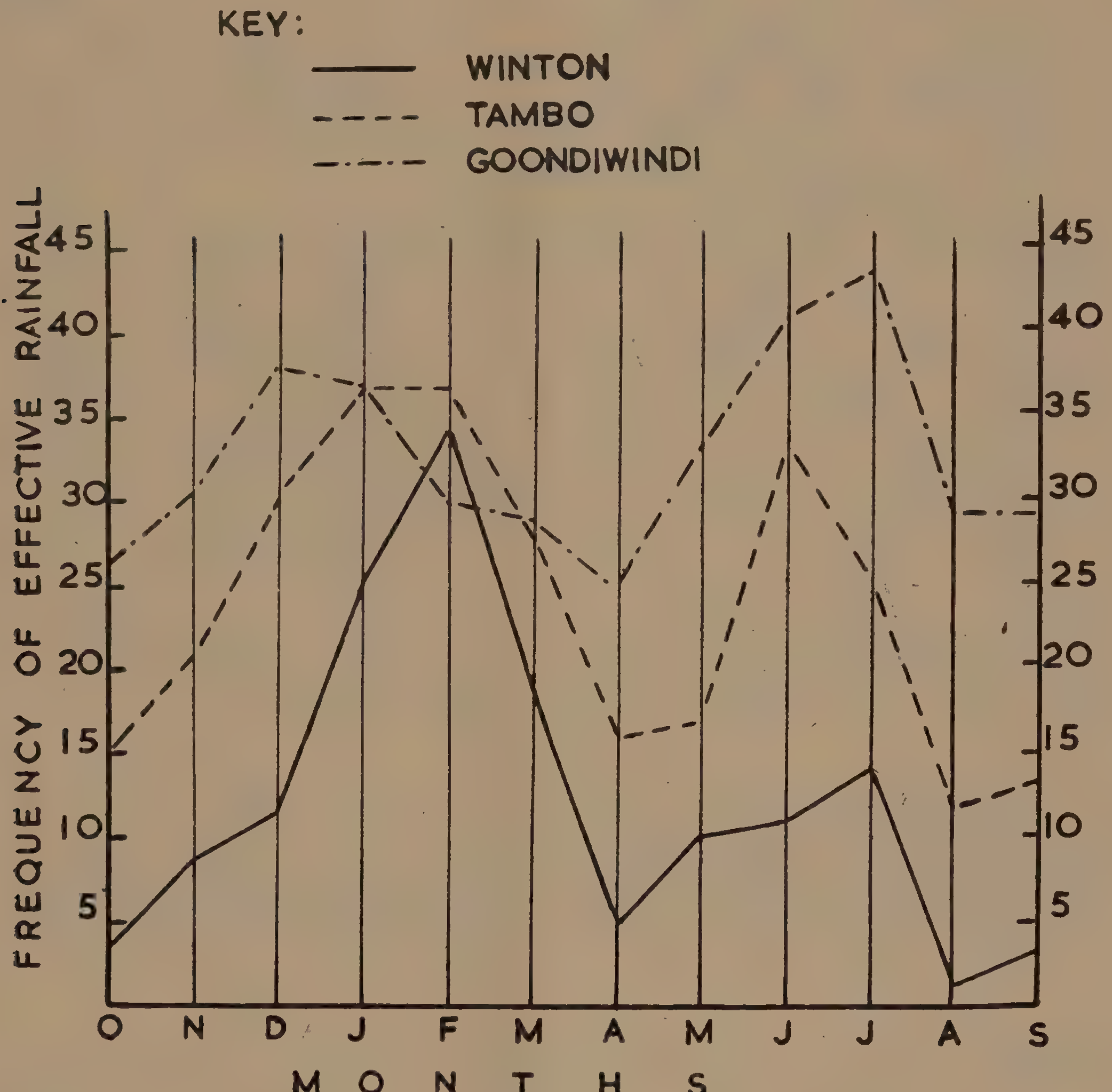

Figure 7.

Graph Showing Frequency of Effective Rainfall in Each Month Over the Period 1893-1948. The number of years (out of 55) in which sufficient rain fell to stimulate grass growth is shown on the vertical scale. Months of the year are shown on the horizontal scale.

It is clear from Figure 7 that:—

(1) Summer rains have occurred more frequently at Winton than winter rains.

(2) Summer rains have occurred more frequently at both Tambo and Goondiwindi than at Winton.

(3) Winter rains have occurred more frequently at Goondiwindi than at either Tambo or Winton.

(4) Winter rains have occurred more frequently at Tambo than at Winton.

This graph shows the usual rainfall pattern for the three districts and can be used in planning drought feeding. It is clear from the graph that if the summer rains fail at Winton, there is a comparatively slender chance of useful rains falling in the winter. Therefore, if it

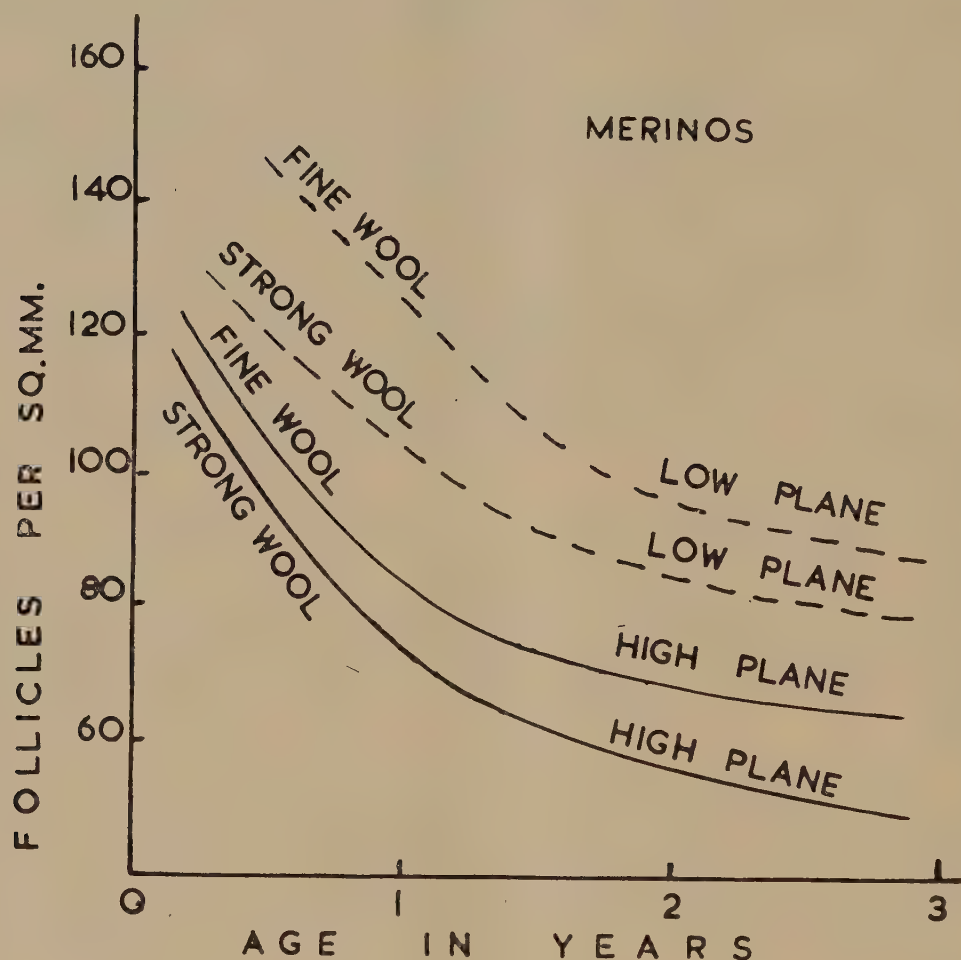

Figure 8.

Graph Showing the Effect of the Plane of Nutrition During Growth on the Follicle Population Density of Merinos. The vertical scale shows the number of fibres per square millimetre (645.2 square millimetres = 1 square inch). The horizontal scale shows the age of the sheep in years. The curved lines represent the change in the number of fibres per square millimetre as the sheep grew older, depending on whether they were poorly or well fed.

is necessary to commence hand feeding in April or May, the graph indicates it may be necessary to continue this practice until the following summer. The graph also shows that at Goondiwindi there is a far greater chance of winter rain, and even if it is necessary to commence hand feeding in April or May, there is a good chance it may not be necessary to continue past June or July.

This is the simplest use of a graph—to convey a general impression. However, graphs can also be used to bring out the connection between more than two sets of circumstances. Such graphs find wide application. Figure 4 is one of this type. A further example is in Figure 8, which

shows the effect of different levels of feeding during growth on follicle population density of Merinos in terms of fibres per square millimetre. This information was obtained by keeping separate groups of fine and strong wool Merino lambs on either a high or a low plane of nutrition and studying the density in terms of fibres per square millimetre as the sheep grew older. This graph actually involves four variables—age, type of sheep, plane of nutrition and follicles per square millimetre.

It is clear from the graph that the fine wool Merinos kept on a low plane of nutrition were denser than comparable sheep which were well fed. This is because the poorly fed sheep did not grow as big as the well fed sheep and consequently they had a smaller total skin area. The strong wool sheep behaved similarly, but the fine wool sheep were always denser than the strong wool sheep which received similar treatment.

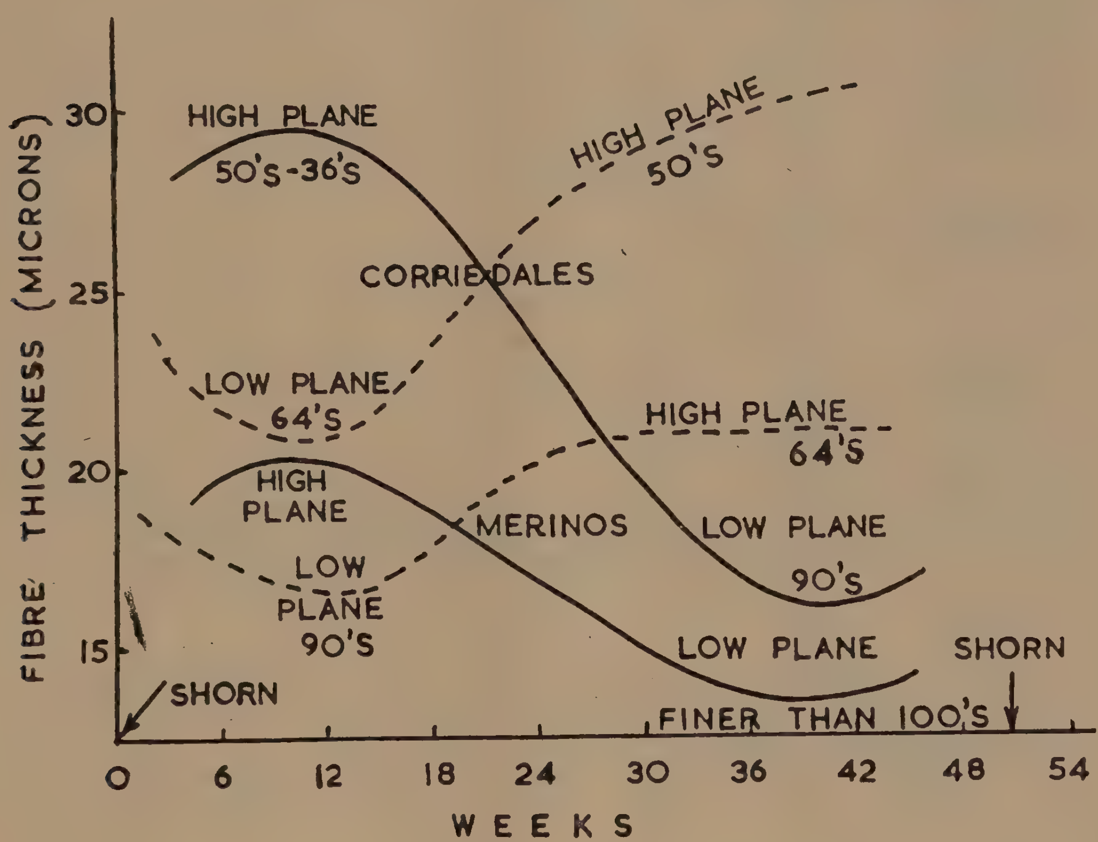

Figure 9.

Graph Showing the Effect of the Plane of Nutrition on Fibre Thickness in Adult Corriedales and Merinos. The fibre thickness is shown in microns (1 micron = 1/10,000 of a centimetre; 1 centimetre = 0.39 inch). The time in weeks is shown on the horizontal scale.

Figure 9, which shows the effect of plane of nutrition on fibre thickness in adult sheep, is also of this type, the four variables here being fibre thickness, time, plane of nutrition and breed.

Corriedale and Merino sheep were used in this experiment and representatives from each breed were subdivided into two groups. One group from each breed was started on a high plane of nutrition, which was reduced to a low plane after the 12th week. The other group from each breed was started on a low plane of nutrition, which was increased to a high plane, after the 12th week.

The continuous lines depict the performance of the sheep moved from the high to the low plane of nutrition and the dotted lines the performance of the sheep moved from the low to the high plane of nutrition.

The curves show that the fibre thickness of wool grown by both Merinos and Corriedales decreases when the sheep are changed from a high to a low plane of nutrition. Conversely, an increase in fibre diameter occurred when the plane of nutrition was raised from low to high.

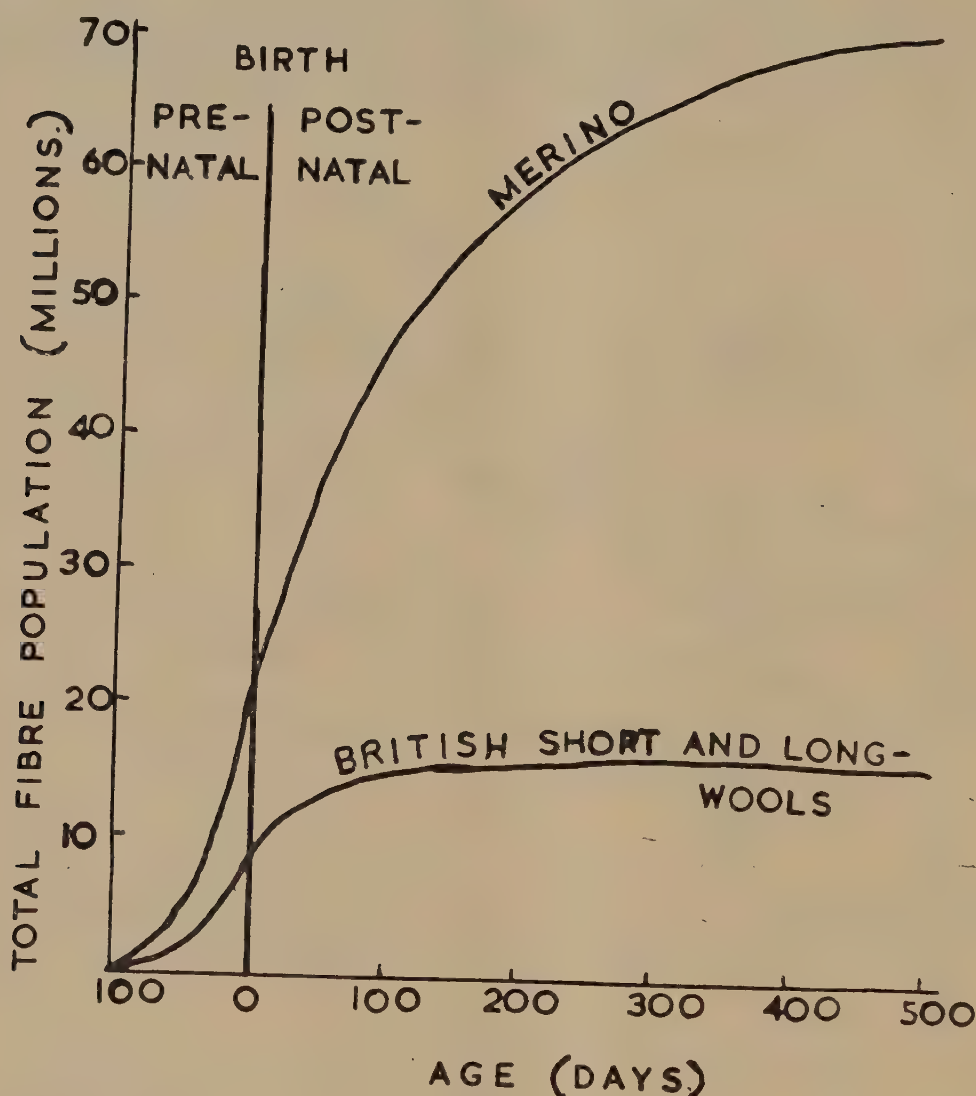

Figure 10.

Graph Showing the Growth of Total Fibre Population with Age. The total number of fibres (in millions) growing on the surface of the skin is shown on the vertical scale and time (in days) on the horizontal scale.

Part of the science of interpreting graphs consists in knowing how a graph looks when something is increasing or decreasing, whether it be at a uniform rate, at an accelerating rate or at a diminishing rate. Figure 10 shows that the rate of increase of the total fibre population in sheep decreases as the sheep grows older.

Merino and British breeds of sheep are compared. It is seen that there is very little increase in the total fibre population of sheep of the British breeds after they attain 100 days of age but that of Merino sheep may continue to increase until the sheep are 400 days old.

While total fibre population increases with age, actual population density, or number of fibres per unit area, decreases with age. This is shown in Figure 11, in which the curved lines represent the changes in the density in terms of the fibre population per square millimetre of Merinos and Lincolns as they grow older. The decrease in density is caused by the skin area increasing at a greater rate than the total fibre population.

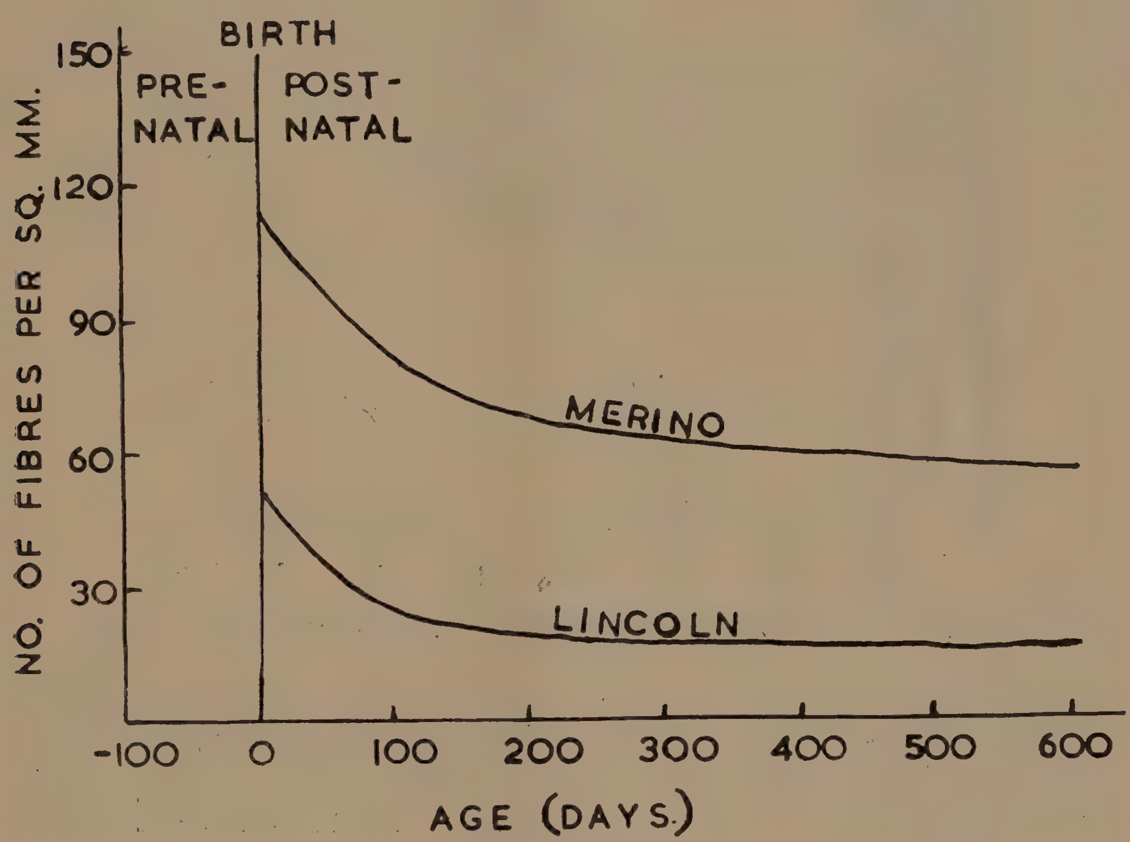

Figure 11.

Graph Showing Change in Fibre Population Density with Age. The fibre population density, as number of fibres per square millimetre, is shown on the vertical scale, and the age (in days) is plotted along the horizontal scale.

So far the conclusions drawn from the graphs have been of a rather general nature, with very little importance being placed on actual values. However, as well as being used to convey a general impression, graphs can be employed by the mathematician for detailed study of many problems. As the result of investigation a mathematical formula may have been found to apply to a particular problem, but the meaning of it may not be readily seen until a graph of the formula is drawn.

In pastoral pursuits it is often desirable to determine if two factors are associated. This can be very difficult, but it is often helpful to present the results of various observations by means of a graph, and from its shape some indication of association can be obtained. In this way graphs may be used to detect correlations between certain physical quantities, as is the case in Figure 12, where the percentage of lambs marked to ewes mated during the years 1896-1930 has been plotted against the inches of rain during the first month of lambing and the month previous to it.

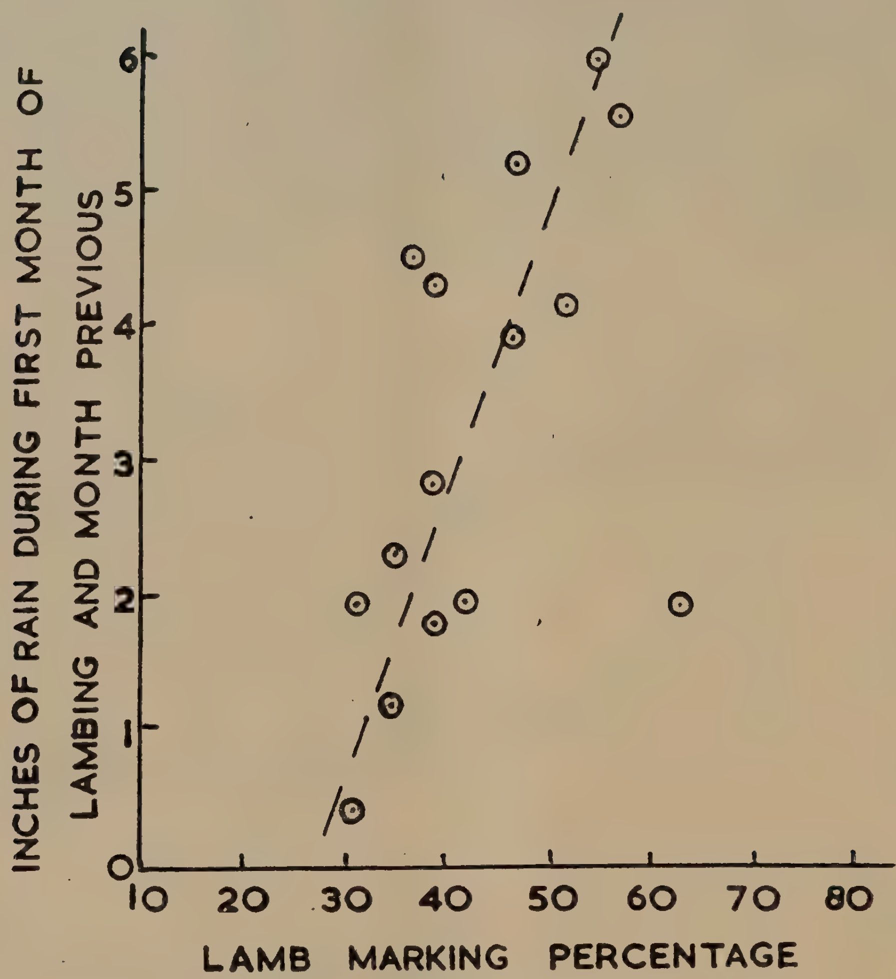

Figure 12.

Graph Showing Correlation Between Lamb-marking Percentages and Rainfall for August-October Matings of the Years 1896-1930. Inches of rain are shown on the vertical scale and the lamb-marking percentages on the horizontal scale. Each point represents the result for one year. The dotted line shows the general trend of the association between the rainfall prior to and at the time of lambing and the lamb-marking percentages. The general increase in lamb-marking percentage with increase in rain is apparent, but the points to the left of the dotted line in the upper portion of the graph indicate that too much rain in too short a time can decrease lamb-marking percentages.

There are times, however, when data may well be left in the form of a graph, for ease of use, rather than be presented as a complicated formula. Mathematical equations by means of which the amount of culling that can be undertaken in a flock may be found have been developed. These involve the mean number of matings per head, the annual lamb-marking percentage for the flock, the average annual death rate, and the actual number of matings for the flock. As such these equations are rather complicated, and to obtain numerical results from them a large amount of arithmetic is required. However, from the graphs for the corresponding death rate the information can be read directly. These graphs are drawn by plotting the mean number of matings at various lamb-marking percentages, as calculated from the equations. An initial amount of work is entailed in drawing the graphs at various death rates, but then they form a permanent record for future reference. Figure 13 shows the mean number of matings per head and the actual number of matings per group at various lamb-marking percentages and levels of culling for a death rate of 10 per cent.

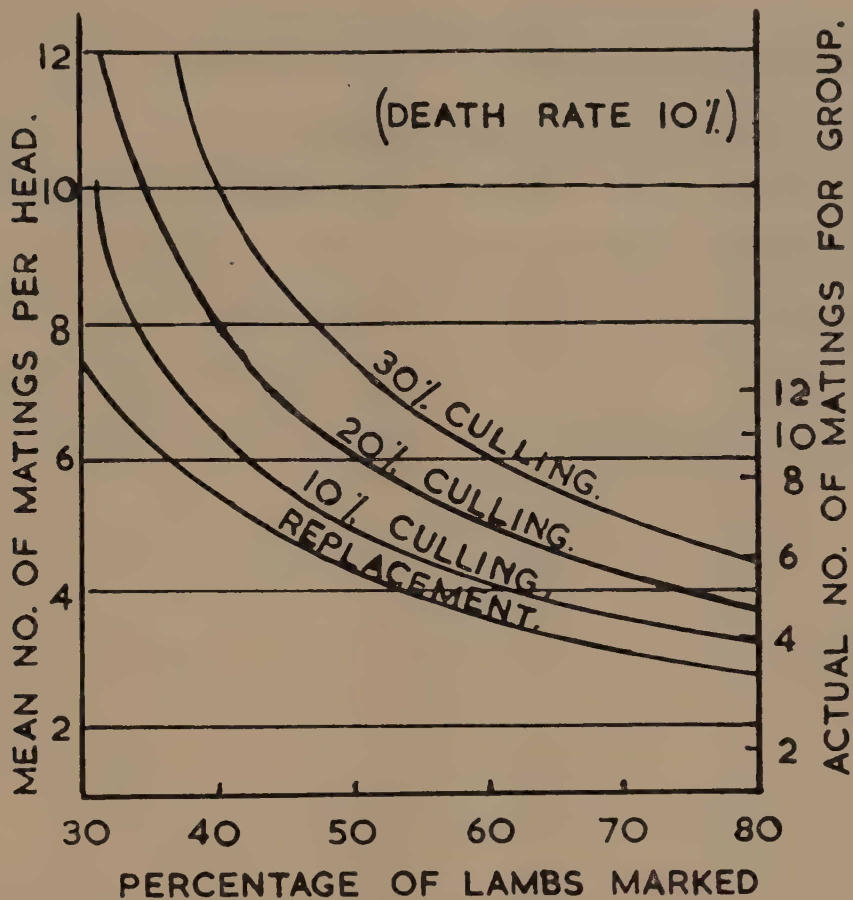

Figure 13.

Curves Showing Number of Matings and Lamb-marking Percentages Required for Various Levels of Culling. The mean number of matings required per head is shown on the vertical scale on the left and the average lamb-marking percentages are on the lower horizontal scale. Different culling rates are shown on the curved lines and the number of years a group of ewes must be mated to achieve the average number of matings per head is shown on the right-hand vertical scale. This has been calculated for an average loss of 10 per cent. per annum.

Suppose a flock maintains an average lamb-marking percentage of 40 and an average of 6 breeding seasons can be secured from the ewe flock. Lines drawn at right angles from the points marked 40 (on the base line and 6 (on the left-hand vertical line) intersect just below the 10 per cent. culling line, indicating that it is possible to cull a few less than 10 per cent. of young ewes. The horizontal line drawn from the point 6 strikes the right-hand vertical line about the point 9, which means that the flock will have to be mated 9 times to allow for the death rate of 10 per cent. on which the graph is based.

In the case of a lamb-marking percentage averaging 75 and an average of 4.5 matings per ewe, the procedure outlined above will show that 30 per cent. of the young ewes may be culled and that the flock must be mated 6 times.

Sometimes cases arise where single quantities only are to be represented, and for these such schemes as shaded areas, lengths of lines, areas of rectangles and so on may be used. An instance of this would be the dissection of production costs per pound of wool into charges for shearing, wages, cartage, repairs, rates, marketing, etc., in which case a series of lines of heights equivalent to cost may be used as in Figure 14.

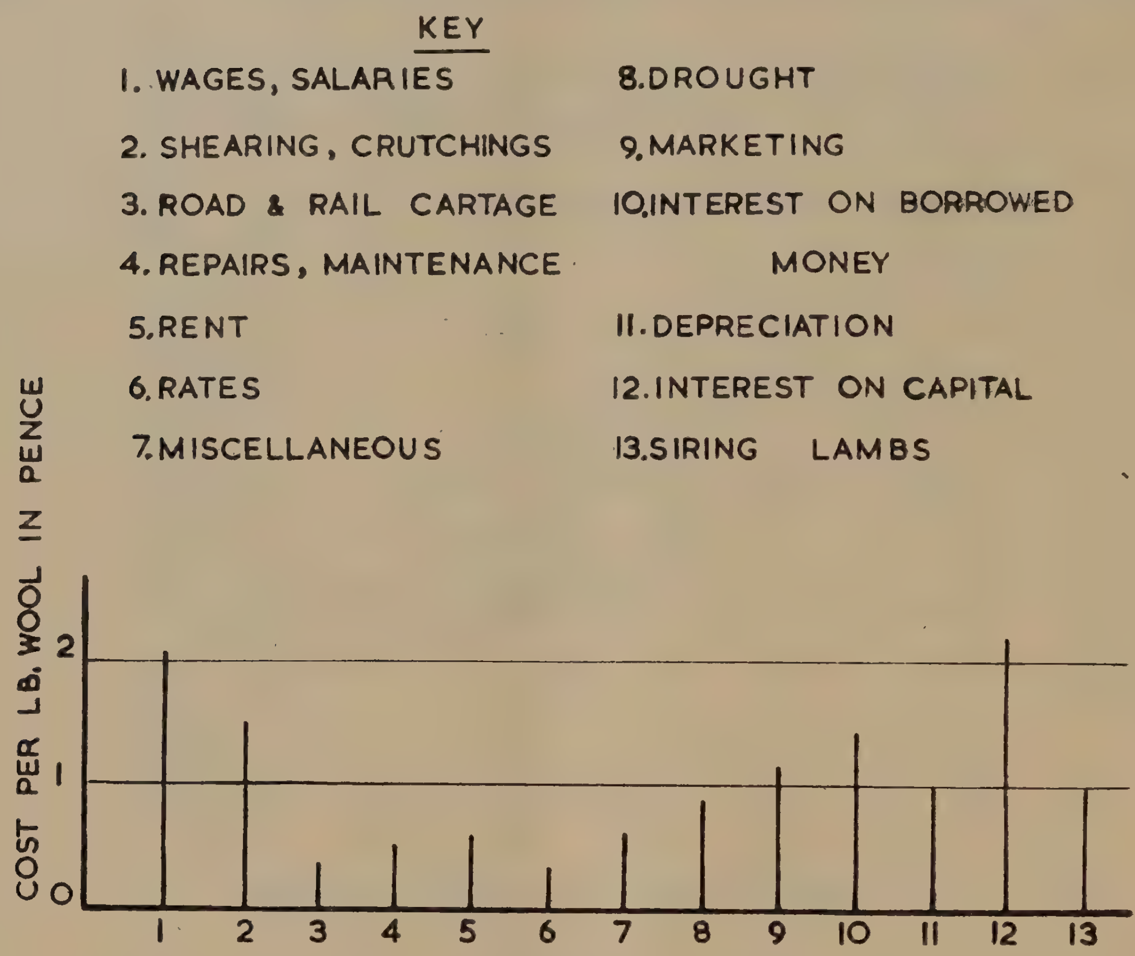

Figure 14.

Graphical Dissection of Average Wool Production Cost in Queensland in 1939. The vertical scale represents the production cost of wool in pence per pound in 1939. The figures on the horizontal scale refer to the various items of expenditure which contribute to production costs and which are listed in the key.

The figures vary from locality to locality and also from year to year; hence such diagrams afford a ready means of comparing the fluctuations. The costs shown in Figure 14 were the average figures for Queensland in 1939 and consequently are far below those of the present day. For their own information, woolgrowers may like to draw graphs of their own production costs for 1951.

Acknowledgments.

Information used in the graphs has been obtained from records of the Sheep and Wool Branch, and from published works by Miss H. Newton Turner, Mr. H. B. Carter and Mr. W. Granger, to whom the author wishes to express his indebtedness.

Advice on Soils and Fertilizers.

Farmers are requested to contact their district Adviser in Agriculture or Adviser in Horticulture if they desire advice on fertilizing or other soil treatments. If a soil analysis is conisdered necessary by the field officer, he will provide directions for the taking of samples.

Brucellosis Testing of Swine.

The Department of Agriculture and Stock is operating a scheme whereby pig herds are tested at intervals for the occurrence of swine brucellosis (contagious abortion).

A herd listed by the Department as ''brucellosis tested'' is one in which all such animals as may be determined by the Director of the Department's Division of Animal Industry have been subjected to two successive tests for brucellosis, at intervals determined by him, without any positive reactors being found.

In order for a herd to be retained on the list of Tested Herds, a semi-annual or annual re-test of the herd, as determined by the Director, is required. If at a re-test any animal gives a positive reaction to the test the herd is removed from the list; it is not listed again until subsequent tests, as determined by the Director, have been carried out.

Full particulars of the Brucellosis Testing of Swine and application forms may be obtained from the Under Secretary, Department of Agriculture and Stock, William Street, Brisbane.

TESTED HERDS.
(AS AT 15th FEBRUARY, 1952.)

Breed.	Owner's Name and Address of Stud.
Berkshire	S. S. Ashton, " Scotia " Stud, Pittsworth
	J. J. Bailey, " Lucydale " Stud, East Greenmount
	S. Cochrane, " Stanroy " Stud, Felton
	Garrawin Stud Farm Pty. Ltd., 657 Sandgate road, Clayfield
	G. Handley, " Handleigh " Stud, Murphy's Creek
	J. L. Handley, " Meadow Vale " Stud, Lockyer
	R. G. Koplick, " Melan Terez " Stud, Rochedale
	H. V. Littleton, " Wongalea " Stud, Crow's Nest
	O'Brien and Hickey, "Kildurham" Stud, Jandowae East
	E. Pukallus, " Plainby " Stud, Crow's Nest
	G. C. Traves, " Wynwood " Stud, Oakey
	E. Tumbridge, " Bidwell " Stud, Oakey
	Westbrook Farm Home for Boys, Westbrook
	H. W. Wyatte, Rocky Creek, Yarraman
	H. M. State Farm, " Palen Creek," Palen Creek
	A. R. Ludwig and Sons, " Cryna " Stud, Beaudesert
	H. H. Sellars, " Tabooba " Stud, Beaudesert
	F. Thomas, " Rosevale " Stud, Beaudesert
	Bowkett and Meacle, " Myola Vale " Stud Piggery, Burra Burri, Jandowae
	D. T. Law, Trouts Road, Aspley
	R. J. McCullough, " Maxholm " Berkshire Stud, Gatton
	C. F. W. and B. A. Schellback, " Redvilla " Stud, Kingaroy
	R. H. Crawley, " Rockthorpe " Stud, *via* Pittsworth
	F. R. J. Cook, " Alstonvilla," Wolvi, via Gympie
	D. E. and E. C. Apelt, "Thelmur," Oakey
	Mrs. I. M. James, "Kenmore" Stud, Cambooya
Large White	H. J. Franke and Sons, " Delvue " Stud, Cawdor
	Garrawin Stud Farm Pty. Ltd., 657 Sandgate road, Clayfield
	F. L. Hayward, " Curyo," Jandowae
	J. A. Heading, " Highfields," Murgon
	K. B. Jones, " Cefn " Stud, Pilton
	R. G. Koplick, "Melan Terez " Stud, Rochedale
	R. Postle, " Yaralla " Stud. Pittsworth
	E. C. Smith, " Smithfield " Stud, Coomera
	E. J. Bell, " Dorne " Stud, Chinchilla
	A. G, Fry, "Birubi" Stud, Dalby
	N. E. Myers, Halpine Plantation, Kallangur

TESTED HERDS—continued.

Breed.	Owner's Name and Address of Stud.
Large White—*continued*	L. C. Lobegeiger, "Bremer Valley" Stud, Moorang, *via* Rosewood
	J. H. G. Blakeney, "Talgai" Stud, Clifton
	V. P. McGoldrick, "Fairymeadow" Stud, Cooroy
	N. Woltmann and Sons, Wooroolin
	R. S. Powell, Kybong, via Gympie
	E. B. Horne, "Kalringal," Wooroolin
	S. T. Fowler, "Kenstan" Stud, Pittsworth
	J. A. and J. McNicol, "Camden," Canning Vale, Warwick
Tamworth	S. Kanowski, "Miecho" Stud, Pinelands
	N. R. Potter, "Actonvale" Stud, Wellcamp
	D. F. L. Skerman, "Waverley" Stud, Kaimkillenbun
	A. C. Fletcher, "Myola" Stud, Jimbour
	L. C. Lobegeiger, "Bremer Valley" Stud, Moorang, *via* Rosewood
	Salvation Army Home for Boys, Riverview
	F. Thomas, "Rosevale" Stud, Beaudesert
	A. J. Surman, Noble Road, Goodna
	P. V. McKewin, "Wattleglen" Stud, Goombungee
	Department of Agriculture and Stock, Regional Experiment Station, Kairi
	P. V. Campbell, Lawn Hill, Lamington
	E. C. Phillips, "Sunny View," M.S. 90, Kingaroy
	T. A. Stephen, "Withcott," Helidon
Wessex Saddleback ..	W. S. Douglas, "Greylight" Stud, Goombungee
	K. Day and P. Hunting, "Kazan" Stud, Goodna
	E. Sirrett, "Iona Vale" Stud, Kuraby
	C. R. Smith, "Belton Park" Stud, Nara
	H. H. Sellars, "Tabooba" Stud, Beaudesert
	H. Thomas, "Eurara" Stud, Beaudesert
	D. T. Law, Trouts Road, Aspley
	G. J. Wilson, "Glenbella" Stud, Silverleigh
	G. J. Cooper, "Cedar Glen," Yarraman
	J. B. Dunlop, Acacia Rd., Kuraby

HAVE YOUR SEEDS TESTED FREE

The Department of Agriculture and Stock examines FREE OF CHARGE samples representing seed purchased by farmers for their own sowing.

The sample submitted should be representative of the bulk and a covering letter should be sent advising despatch of the sample.

MARK YOUR SAMPLE

Sample of .... seed
Drawn from .... bags
Representing a total of ....
Purchased from ....
Name and Address of Sender
Date....................

SIZE OF SAMPLE

Barley -	8 oz.	Oats -	8 oz.
Beans -	8 oz.	Peas -	8 oz.
Grasses	2 oz.	Sorghum	4 oz.
Lucerne	4 oz.	Sudan -	4 oz.
Millets	4 oz.	Wheat -	8 oz.
Vegetable Seeds -	½ oz.		

SEND YOUR SAMPLE TO—**STANDARDS OFFICER, DEPARTMENT OF AGRICULTURE AND STOCK, BRISBANE.**

ASTRONOMICAL DATA FOR QUEENSLAND.

APRIL.

Supplied by W. J. NEWELL, Hon. Secretary of the Astronomical Society of Queensland.

TIMES OF SUNRISE AND SUNSET.

At Brisbane.			MINUTES LATER THAN BRISBANE AT OTHER PLACES.					
Day.	Rise.	Set.	Place.	Rise.	Set.	Place.	Rise.	Set.
	a.m.	p.m.						
1	5·57	5·47	Cairns ..	20	38	Longreach	31	39
6	6·0	5·41	Charleville ..	26	28	Quilpie	36	34
11	6·02	5·36	Cloncurry	44	56	Rockhampton ..	6	14
16	6·05	5·30	Cunnamulla ..	30	28	Roma	16	18
21	6·08	5·26	Dirranbandi ..	20	18	Townsville ..	18	33
26	6·10	5·21	Emerald	15	23	Winton	35	45
30	6·12	5·18	Hughenden ..	29	41	Warwick	5	3

TIMES OF MOONRISE AND MOONSET.

At Brisbane.

Day.	Rise.	Set.
	p.m.	p.m.
1	12·02	10·15
2	12·52	11·10
3	1·35	..
		a.m.
4	2·13	12·06
5	2,47	1·02
6	3·19	1·57
7	3·48	2.51
8	4·16	3·45
9	4·46	4·40
10	5·17	5·37
11	5·52	6·36
12	6·32	7·38
13	7·18	8·43
14	8·12	9·49
15	9·12	10·53
16	10·18	11·52
		p.m.
17	11·26	12·44
18	..	1·30
	a.m.	
19	12·33	2·09
20	1·38	2·45
21	2·42	3·19
22	3·45	3·52
23	4·46	4·25
24	5·48	5·02
25	6·51	5·40
26	7·53	6·24
27	8·54	7·12
28	9·51	8·04
29	10·43	8·59
30	11·29	9·55

MINUTES LATER THAN BRISBANE (SOUTHERN DISTRICTS).

Charleville 27 ; Cunnamulla 29 ; Dirranbandi 19;
Quilpie 35 ; Roma 17 ; Warwick 4.

MINUTES LATER THAN BRISBANE (CENTRAL DISTRICTS).

Day.	Emerald.		Longreach.		Rockhampton.		Winton.	
	Rise.	Set.	Rise.	Set.	Rise.	Set.	Rise.	Set.
1	9	30	25	45	0	21	26	54
6	14	25	30	41	5	16	34	47
11	25	14	42	29	17	4	49	33
16	30	9	45	24	20	0	53	26
21	21	19	37	34	12	10	43	39
26	11	29	26	44	0	20	28	52
30	10	29	25	44	0	20	27	52

MINUTES LATER THAN BRISBANE (NORTHERN DISTRICTS).

Day.	Cairns.		Cloncurry.		Hughenden.		Townsville.	
	Rise.	Set.	Rise.	Set.	Rise.	Set.	Rise.	Set.
1	2	56	33	67	17	53	3	46
3	6	51	35	64	20	50	6	43
5	14	47	39	62	24	47	13	39
7	23	38	46	56	30	41	20	33
9	34	27	53	48	38	33	28	23
11	44	16	61	41	45	26	37	15
13	53	6	67	34	50	20	44	7
15	56	2	68	32	52	17	46	3
17	51	6	65	34	49	20	42	7
19	45	15	61	41	46	26	37	14
21	34	27	53	48	38	33	28	23
23	21	38	44	57	29	42	18	33
25	11	49	38	63	23	49	10	41
27	3	55	34	67	18	52	4	45
29	3	55	34	67	18	52	4	45
30	5	52	35	65	19	50	5	44

Phases of the Moon.—First Quarter, April 2nd, 6.48 p.m.; Full Moon, April 10th, 6.53 p.m.; Last Quarter, April 17th, 7.07 p.m.; New Moon, April 24th, 5.27 p.m.

On April 15th the sun will rise and set about 10 degrees north of true east and true west respectively, and on the 9th and 21st the moon will rise and set approximately at true east and true west respectively.

Mercury.—In the constellation of Pisces all this month. On the 1st this planet will set about sunset. On the 17th it will pass to the north of Venus and by the end of the month will rise about 2 hours before the sun.

Venus.—Also in the constellation of Pisces throughout this month. On the 1st rising about 1½ hours before the sun and by the 30th rising only 1 hour 8 minutes before sunrise. The moon will be in the vicinity of Mercury and Venus on the 23rd.

Mars.—Remains in the constellation of Libra all this month, rising between 7.30 p.m. and 8.45 p.m. on the 1st and at sunset on the 30th.

Jupiter.—Now too close in line with the sun for observation.

Saturn.—In the constellation of Virgo, will rise about sunset at the beginning of April and will be well above the eastern horizon at nightfall at the end of the month.

THE CONSTELLATIONS.

GEMINI (THE TWINS).

This is a zodiacal constellation and takes its name from its two principal stars, Castor and Pollux (Alpha and Beta). Castor and Pollux were the twin brothers of Helen of Troy and went with Jason and his Argonauts on the search for the Golden Fleece. During a violent storm, Orpheus, one of the heroes, invoked the aid of Apollo, the God of Light, who caused a star to shine on the head of each of the twins. The constellation shows up as roughly rectangular with the stars Alpha (Castor) and Beta (Pollux) and Gamma at three of the corners and Mu and Eta at the other.

Epsilon and Delta appear along the longer sides of the figure, with Delta, which is almost on the ecliptic, not quite halfway from Beta to Gamma. Eta, at the opposite end of one diagonal of the Gemini rectangle from Pollux, is an orange coloured star and Gamma is a pale blue. Not far to the north-east from Eta is M35, a fine, loose star cluster. About 3 degrees east and one degree south of Delta is N.G.C. 2329, an oval planetary nebula about 25 seconds in diameter with a 9.5 magnitude central star. In this constellation is the radiant point of the meteor shower called the Geminids, which reaches maximum about December 10th, when 20 or more bright, swift moving meteors an hour may be seen.

CANIS MINOR (THE LESSER DOG).

This constellation lies between Canis Major (described in February Journal) and Cancer and is directly south from Castor and Pollux in Gemini. Procyon is the principal star of this group and is a lovely deep yellow star of a binary system which in some ways is like that of Sirius in Canis Major. Procyon B, which was discovered in 1896 by Schaeberle, is only visible in large telescopes, the magnitude being 14 and the separation between the two stars about 44 seconds of arc.

MONOCEROS (THE UNICORN).

A fairly large constellation not conspicuous to the naked eye and lying mainly in the large triangle formed by Sirius, Betelgeuse and Procyon. At about a third of the distance from Betelgeuse to Procyon is one of the most unusual stars yet examined. It is a close binary of total magnitude 6 and is known as "Plaskett's Star" from its discoverer. This binary system has a period of 14½ days. The components are about 56 million miles apart (about five-eighths the distance of Earth from the sun), the mass of the main star being 76 times that of our sun and the companion 63 times that of our sun with a luminosity about 30,000 times as bright as the sun. These two stars are among the most massive known, for stellar masses approaching even 50 times that of our sun are very rare. The constellation, lying in the Milky Way, abounds with objects of interest for telescope observers, 12 Monocerotis being a giant yellow star.

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EXD.

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Citrus Growing.

A. A. ROSS, Horticulturist, Horticulture Branch.

IN 1949-50, the area devoted to citrus in Queensland was 6,640 acres, of which 4,373 acres were in bearing for a yield of 494,640 bushels. Most of the fruit produced is sold on the fresh fruit markets in Queensland, New South Wales and Victoria, but some is exported, principally to oriental countries. A small quantity of lower grade fruit is diverted to processing factories for juice extraction and the manufacture of marmalade and candied peel.

CLASSIFICATION OF CITRUS.

The commercial citrus fruits belong to three closely related genera, *Citrus, Fortunella* and *Poncirus* in the family *Rutaceae.* The classification of this group has proved exceedingly difficult on account of the freedom with which hybridisation occurs between both species and genera. Numerous types, some monstrosities and others with desirable features, have, after careful investigation, proved to be hybrids.

The kumquats (genus *Fortunella*) very closely resemble plants in the genus *Citrus* but their fruits are small with acid pulp and a sweet, edible skin. The two species commonly cultivated in Queensland are the oval kumquat (*F. margarita*) and the round kumquat (*F. japonica*).

The trifoliate orange (genus *Poncirus*) is distinctly different from plants in the genus *Citrus,* particularly as regards its palmately trifoliate leaf and deciduous habit. Only one species, *P. trifoliata,* is of commercial importance; it is being used as a rootstock because of its resistance to low temperatures and brown rot gummosis.

The genus *Citrus* includes many well known species of fruit trees with certain outstanding features.

The citron (*C. medica*) has large lemon-like fruits with thick, white, aromatic peel used mainly for candying. It probably originated in British India.

The lemon (*C. limon*) is a popular acid fruit, mostly oval with a pointed apex and pale yellowish rind. It may be a variety of *C. medica.*

The lime (*C. aurantifolia*) is characterised by greenish-yellow fruits, usually small and globose or oval. The seeds are small and usually few in number. The tree is apparently indigenous to the East Indies.

The sour orange (*C. aurantium*), of which there are numerous varieties and strains, originated in south-eastern Asia and was the earliest orange known to Europeans. The fruit is more acid and has a brighter and rougher peel than the sweet orange. The petioles are broadly winged and the leaves are relatively long and pointed.

The sweet orange (*C. sinensis*) is probably native to south-eastern Asia and becauses of its palatability is now cultivated throughout the world as one of the most important commercial fruits. The fruit is globose or oval with a thin, tight, non-bitter peel. The central core is solid and never becomes hollow as in the sour orange.

The mandarin orange (*C. reticulata*) is characterised by a rather flattened shape, thin loose peel which separates freely from the pulp and a bright orange-scarlet colour when ripe. It originated in the Philippines and is now cultivated in all sub-tropical regions of the world.

The pummelo or shaddock (*C. grandis*) has very large, pale-yellow fruit and huge leaves with broadly winged petioles. The fruit has a thick peel and the juice vesicles are much larger than those of other species of *Citrus* and instead of cohering with one another easily fall apart. The pummelo contains the glucoside naringin in comparatively large amounts, which gives the fruit a distinctive bitter flavour. The pummelo originated in south-eastern Asia and the East Indian Archipelago.

The grapefruit (*C. paradisi*) is somewhat similar to the pummelo and is considered by some authorities to be a variety of that species. The leaves and fruit are smaller than those of the pummelo, and the peel is much thinner. The glucoside naringin is also present in the grapefruit, giving it the distinctive bitter flavour. The grapefruit apparently originated in the West Indies, as there is no native record of it in the Old World.

There are numerous citrus hybrids, both inter-generic and inter-specific, but few of them are commercially superior to the species already referred to. Those which possess the best eating qualities are the tangelos (*C. reticulata* x *C. paradisi*) and the tangors (*C. reticulata* x *C. sinensis*). These are attractive looking, highly flavoured fruit which are sometimes difficult to distinguish from true species. The King of Siam mandarin and the Temple orange of Florida are now known to be tangors. Hybrids between *P. trifoliata* and *C. sinensis* are known as citranges; interest has been shown recently in their use as prospective rootstocks.

CLIMATIC REQUIREMENTS AND DISTRICTS.

Citrus is grown in a wide range of climatic conditions. Orchards bearing crops of good quality fruit are found throughout the whole of Queensland but the main citrus districts lie in the south-eastern corner of the State and are reasonably close to the markets.

The several varieties are somewhat precise in their climatic requirements; for example, lemons and grapefruit prefer dry inland conditions, and Emperor mandarins do best in the humid, coastal areas. High temperatures are tolerated by citrus trees provided soil moisture is maintained at an adequate level, but low temperatures determine the geographical limits for successful production. A sudden fall in temperature may cause serious injury during many winters, especially

in inland areas. Mature trees usually tolerate screen temperatures as low as 24° F. with only slight damage to the leaves, provided such temperatures last only a few hours, but great difficulty is experienced in establishing young trees in cold areas and it is doubtful whether planting should be attempted under such marginal conditions. Some protection can be provided by wrappings of straw or paper or the installation of a heating system, but the extra cost involved may be prohibitive.

The following districts are the main centres of production:—

District.	Principal Towns.
Coastal North Queensland ..	Mainly centred around Cardwell
Charters Towers	Charters Towers and Pentland
Central Queensland ..	Rockhampton, Byfield and Bogantungan
Maryborough	Maryborough, Howard, Burrum and Torbanlea
Central Burnett	Biggenden, Gayndah and Mundubbera
Near North Coast	Nambour, Palmwoods, Montville and Elimbah
Lockyer	Gatton, Grantham and Esk
Maranoa	Roma

SELECTION AND PREPARATION OF LAND.

A site for the citrus orchard should be well drained and have at least two to three feet of topsoil to accommodate a vigorous root system. These requirements are most frequently met by alluvial soils adjacent to rivers and creeks. Although residual soils support very good citrus orchards, they are often inclined to be shallow and poorly drained and are sometimes difficult to work. Loams and sandy loams are preferred for citrus on account of the ease with which they can be managed. Citrus trees are extremely susceptible to alkali injury and where practicable should be planted on land with a soil reaction of pH 6 to 6·5, which is slightly acid.

Plate 100.

A Citrus Orchard in the Lockyer Valley. Some of the oldest orchards in Queensland are found in this district.

A north-easterly aspect is the warmest in Queensland, but in order to minimise loss of soil by erosion, a level or nearly level area is preferable for a citrus orchard. If the slope of the land exceeds 1 in 25 in any direction, consideration should be given to planting on the contour so that soil fertility can be more easily maintained.

A dry spring is usual in most parts of Queensland and frequently good rains do not fall until December. Along the coast, most orchards are managed without irrigation but nearly all would produce better crops if even one irrigation could be applied each spring. In the drier inland areas, irrigation is essential and as many as 10 irrigations may be required in a season.

Preparation of the land must be done thoroughly. Good orchard land normally carries heavy timber; when clearing, large trees have to be felled and their roots removed as a precaution against later infection of the citrus trees by fungi such as *Armillaria* and *Ganoderma*. After clearing, the soil should be ploughed deeply and subsoiled if at all practicable. In the process of clearing, leaf mould and other organic matter should be conserved by avoiding burning as far as possible.

Plate 101.

Nursery Rows of Citrus. Seedlings are transplanted from the seed-bed to nursery rows when they are about nine inches tall.

PROPAGATION AND PLANTING.

Propagation.

Like most other fruits grown for commercial purposes, citrus trees are propagated vegetatively in order to achieve uniformity of tree type. Rootstocks are usually raised from seed which has been extracted from the fruit of vigorous seedling trees (Plate 101). Nursery trees are worked by the simple T bud method. Budded trees should be held in the nursery until they reach a trunk diameter of half an inch or more at a point two inches above the union. By this time they should be sufficiently robust for transplanting (Plate 102).

Plate 102.

Worked Trees in the Nursery Row.

When removing budlings from the nursery, the lateral roots should be cut with a sharp spade about eight inches from the trunk and the taproot severed as deeply as possible. Every care should be taken to preserve the fibrous roots, but where trees are to be transported long distances, the roots are washed to remove the soil and then dipped in a clay puddle before packing (Plate 103). This practice prevents over-rapid drying out.

Plate 103.

Worked Trees Ready for Orchard Planting. Left, showing the root system when lifted from the nursery row. Right, tree ready for despatch from the nursery.

Planting.

In non-irrigated orchards, wide spacings are preferred, but in irrigated orchards 25 feet spacings are common and in some cases the trees are planted as close as 18 feet. Recently, the tendency has been to plant in rectangles, spacings such as 18 x 24 feet being commonly adopted. This system is satisfactory in orchards where soil and tree management is efficient. The trees are usually planted in the spring but in some coastal districts autumn planting is practised. When planted in the autumn, the trees remain dormant until early in spring, but severe winter frosts may be injurious.

When planting, a flat piece of wood about four feet long which is notched at each end and in the centre is used. It is known as a planting board. The central V is placed over the peg marking the tree position and two other pegs are placed in the end V's. The board is then removed. Between the two end pegs, a hole $2\frac{1}{2}$ feet in diameter and about two feet deep is dug. A mound of earth is placed in the centre of the hole and the roots of the tree are arranged around it as evenly as possible. The planting board is replaced with the end V's over the two pegs and the tree trunk in the central V with the union of the tree in such a position as to be above the general soil level (Plate 104). Earth is replaced in the hole and tamped round the roots. When the hole is completely refilled, the board is removed and water immediately applied to a basin made round the tree. After the trees have settled into position, those which have sunk slightly should be raised while the soil is damp after rain or an irrigation and made firm in a higher position so that the union is well above ground level. On no account should fertilizer be placed in the holes at the time of planting, as this may damage the young roots and give the trees a setback. Newly planted trees should be watered regularly until they are firmly established.

Plate 104.

A Young Tree Planted in the Orchard. The stock-scion union is well above ground level.

Characteristics of Good Trees.

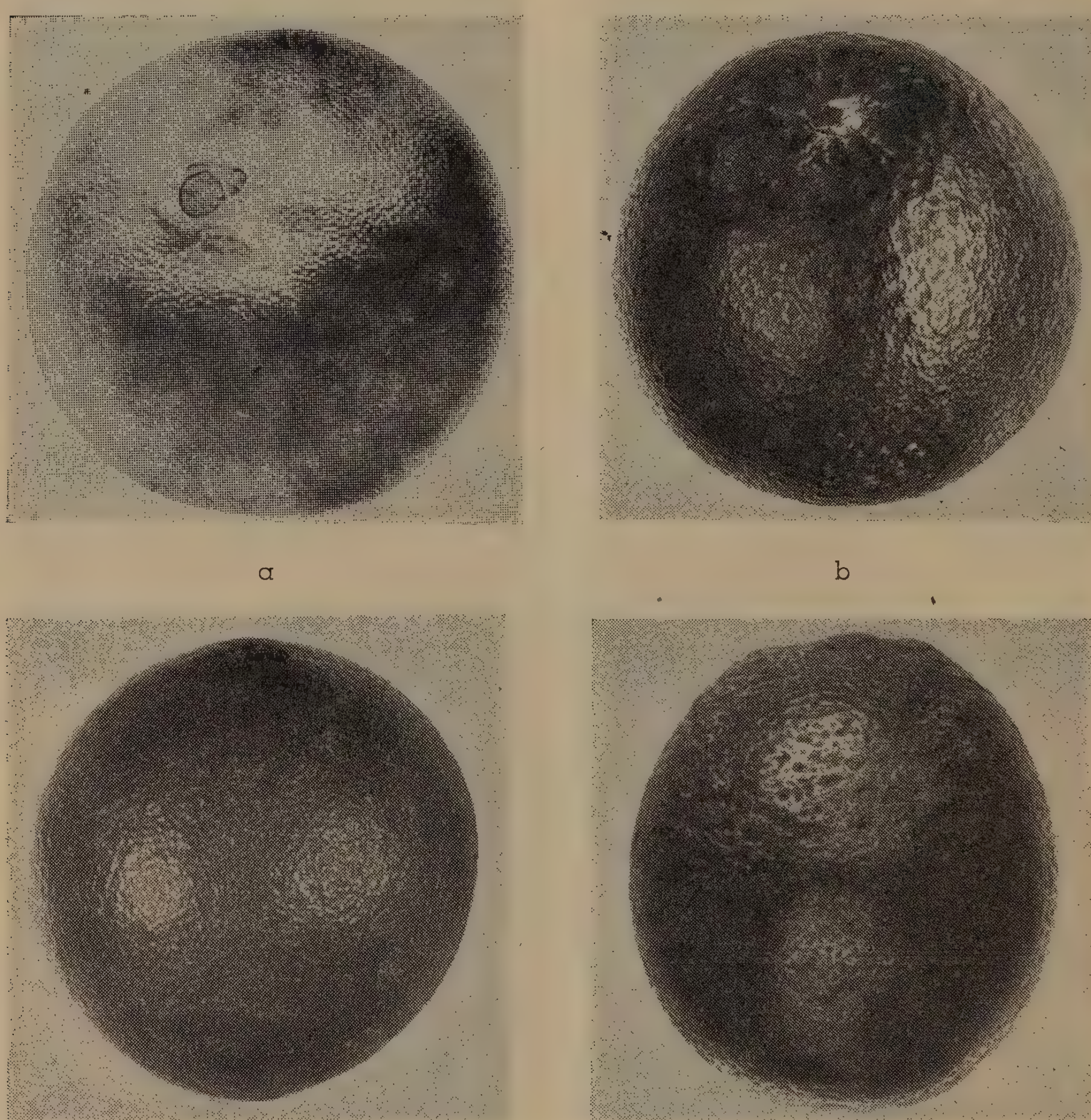
None but the best quality trees should be planted. They should be typical of the variety, of a good cropping strain and well grown. *The Diseases in Plants Acts,* 1929 *to* 1948, require that all worked trees shall be propagated by a single bud or graft (scion) and of one season's growth from such bud or graft; and that trees shall be not less than half an inch in diameter, of upright growth, well developed, and entirely free from any yellowing or chlorotic colouring of foliage.

Before accepting delivery, orchardists should see that the trees comply with these standards.

VARIETIES.

Oranges.

Washington Navel (Plate 105, *a*).—An early maturing variety with a large seedless fruit which is rich in flavour, has a high juice content and a reddish-orange coloured rind of smooth texture. A navel formation at the blossom end of the fruit is characteristic. The mature fruit can be left on the tree for long periods without excessive shedding. Certain strains are subject to poor setting, particularly in coastal districts.



a b c d

Plate 105.

Orange Varieties. a, Washington Navel; b, Late Valencia; c. Joppa; d, Jaffa.

Late Valencia (Plate 105, *b*).—A late maturing variety of world-wide repute which is grown extensively in all districts. The fruit has a rich flavour and plentiful juice content. It keeps well and is therefore suitable for the export trade.

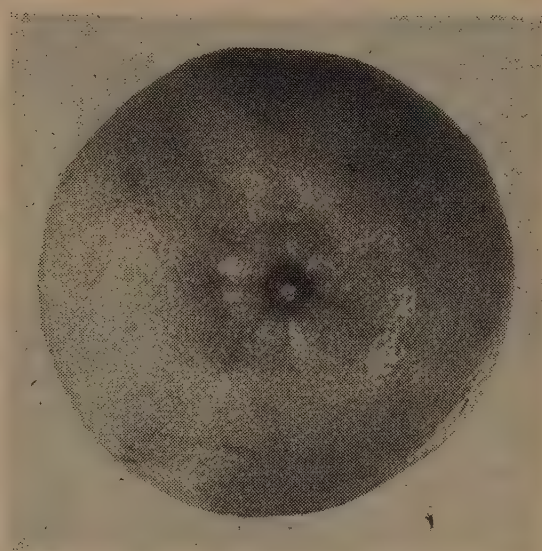
Joppa (Plate 105, *c*).—An early to mid-season variety which does best in the coastal districts, where it largely takes the place of the Washington Navel as an early orange. The flesh is fine grained and has a rich flavour. The fruit is large but rather seedy and therefore less popular than the Washington Navel on the early market.

Other varieties of oranges which produce good crops of excellent quality fruit under certain conditions are the *Jaffa* (Plate 105, *d*), which is popular in the Lockyer district, and the *White Siletta*.

Mandarins.

Beauty of Glen Retreat (Plate 106, *a*).—A mid-season variety with a smooth, thin, reddish rind. The fruit is of excellent quality, with a rich flavour, a plentiful supply of juice and a fine appearance. It is more successful inland than on the coast. The tree tends to over-

a



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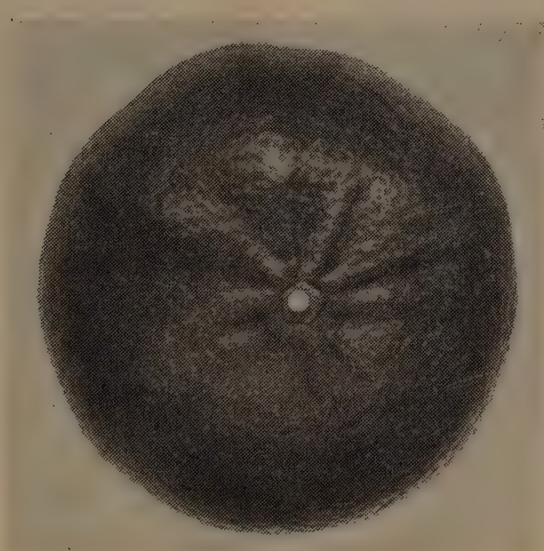


c

Plate 106.

Mandarin Varieties. a, Beauty of Glen Retreat; b, Emperor; c, Ellendale.

bear and heavy hand-thinning of young fruit is necessary. Failure to thin results in heavy crops of small fruit and is frequently associated with dieback in the tree.

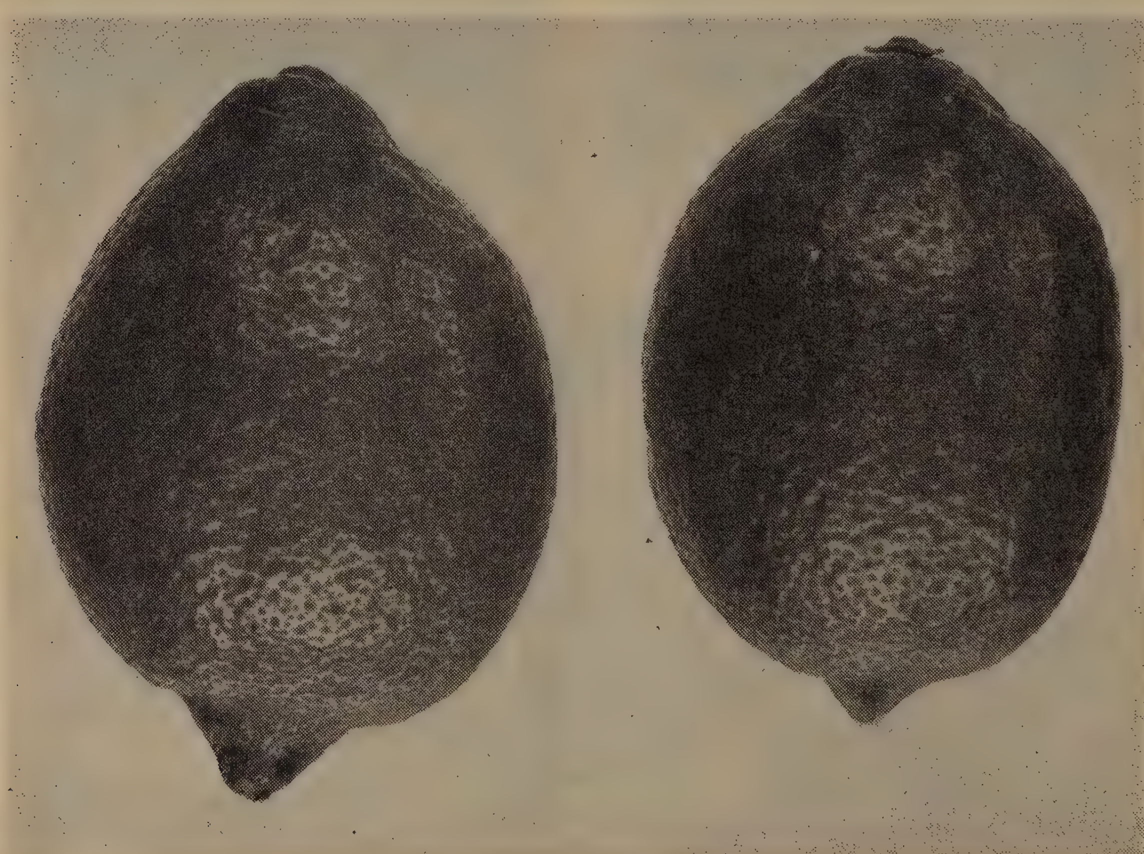
Emperor or *Emperor of Canton* (Plate 106, *b*).—A mid-season variety with a somewhat puffy fruit. The flavour is less acid than that of other mandarins but this does not detract from the market demand. The fruit is large, and has a slightly rough, orange-yellow coloured rind. The Emperor thrives best in coastal areas and it is the main variety grown in the Howard-Burrum-Torbanlea, Byfield, and North Queensland districts. It is, however, susceptible to brown spot disease, which reduces yields in some seasons.

Ellendale Beauty (Plate 106, *c*).—A late variety bearing large fruit with a rich flavour and a high juice content. The flesh is compact and the skin, though easy to remove, fits the fruit firmly. The fruit is deep reddish-orange in colour. This variety thrives in the inland districts under irrigation and does particularly well in the Central Burnett area. It is less suitable for coastal districts, where its two main defects—cracking of the rind at the blossom end of the fruit and splitting of the main limbs at the forks—seem to be accentuated.

Burgess, a related variety, which was derived from the Ellendale, does well in some coastal districts, where it has commercial possibilities as a mid-season to late maturing type.

Lemons.

Villa Franca (Plate 107, *a*).—An early to mid-season variety which tends to produce a large proportion of summer fruit. The fruit is of excellent quality, contains a plentiful supply of juice and has a



a b

Plate 107.

Lemon Varieties. Left, Villa Franca; right, Lisbon.

fine, thin rind. The tree grows vigorously and is almost totally devoid of thorns. It is the most popular lemon variety grown in Queensland and grows best in inland districts. It is, however, susceptible to a rind breakdown known locally as "March Disease" which causes considerable losses when the wet season is prolonged.

Lisbon (Plate 107, *b*).—A mid-season variety producing fruit of excellent quality with plentiful juice and a fine rind. The tree is rather larger than the Villa Franca and carries numerous thorns, which are responsible for its lack of popularity.

Eureka and *Genoa* have never become popular in Queensland and are only grown on a small scale.

Grapefruit.

Marsh (Plate 108).—An early, seedless variety which is suited to inland districts, where it produces heavy crops of excellent quality fruit. It has a pale-coloured rind and pallid flesh. In the past, it has been popular on the early market in Melbourne.

Other varieties are seedy and of no commercial importance at present. *Fosters Pink Flesh* has an excellent flavour and appearance. *Triumph* is a smaller tree than the Marsh and produces heavy crops. *Duncan* carries good crops of relatively large fruit. *Wheeny* shows promise on sweet orange and trifoliata rootstock but grows too large on rough lemon.

Plate 108.
Marsh Grapefruit.

Miscellaneous Citrus Fruits.

Limes.—Limes are seldom grown commercially in Queensland. The fruit of the Tahiti variety is very susceptible to stylar end rot, a disease which destroys a large proportion of the crop. The West Indian variety has become naturalised in parts of coastal North Queensland.

Sour Oranges.—The commonest variety of the sour oranges is the Seville, which grows very vigorously in Queensland. The fruit is used in the manufacture of marmalades.

Kumquats.—The kumquats used for jam-making and conserves are found only as odd trees in a few orchards. There are two main types, the round and the oval.

Citrons.—Citrons are not grown commercially in Queensland as their sole use is in the manufacture of peel, for which there is a very limited demand.

Citrus Hybrids.—There are several citrus hybrids, such as tangelos, tangors and citranges, but, on present indications, none is likely to replace the established true citrus varieties.

ROOTSTOCKS.

The majority of the trees in Queensland orchards are worked on rough lemon rootstock and almost all the rest are on sweet orange. A few mandarins are worked on Emperor mandarin. The behaviour of various rootstocks in Queensland is summarised hereunder.

Rough Lemon (Citronelle).

The rough lemon is one of the most vigorous rootstocks and produces trees which commence bearing at a comparatively early age and ultimately develop to a large size. The fruit of varieties worked on it is apt to have a rather flat flavour and a pale, coarse-textured, thick rind. With Late Valencia oranges, it encourages re-greening of the rind and granulation or drying of the juice sacs when the fruit is held on the trees. The root system is extensive and this stock is therefore suitable for droughty conditions and light sandy soils. It is very susceptible to brown rot gummosis in wet and heavy soils and its sensitivity to frost is imparted to trees worked on it.

Sweet Orange.

Trees on sweet orange grow more slowly in their early years than trees on rough lemon but they usually overtake the latter at about eight years. Young trees grow slowly and sometimes require one year more in the nursery than those worked on rough lemon stocks. Sweet orange rootstock is compatible with all commercial varieties and the worked trees ultimately become large and shapely and produce fruit of excellent quality with a fine texture, highly coloured rind and a plentiful supply of juice. This rootstock is shallow rooted and therefore less successful under dry conditions than the rough lemon, but it is slightly more tolerant to brown rot gummosis, a common disease in coastal areas.

Trifoliate Orange.

In Queensland, trifoliate orange is a comparatively new rootstock which should prove useful for certain varieties. With mandarins and the Late Valencia orange, it has given satisfactory results. Nursery growth is vigorous, upright and thorny. It has a slight dwarfing effect

on scions (with the exception of the Late Valencia) promotes fruit production at an early age and supports long-lived trees. The fruit of Valencia oranges worked on trifoliate stock is usually excellent in quality, of medium size and has a fine textured rind. On lighter soils, there is a tendency towards the development of granulation, ragginess and puffiness in the fruit. Trees on this stock are usually resistant to collar rot and brown rot gummosis and less susceptible to frost damage than those on any other stock.

Sour Orange.

Seedlings of sour orange have a deep taproot and grow poorly in the nursery. This stock is suitable for grapefruit but is incompatible with several of the lemon varieties, particularly Eureka. Sour orange rootstock produces fruit of good flavour and texture and imparts long life and high cropping capacity to the trees. It is tolerant of wet soil conditions and resistant to collar rot and brown rot gummosis but it does not withstand dry conditions well. The chief objection to the stock is its susceptibility to Tristeza, or "quick decline" disease, in all countries where it has been used extensively.

Emperor Mandarin.

Emperor mandarin is popular as a rootstock, mainly for the Beauty of Glen Retreat mandarin, in several citrus growing districts. Nursery and early tree growth is relatively slow. It has a deep rooting habit and should do well on the lighter and deeper soils.

MANAGEMENT OF THE TREE.

Like most other fruit trees, citrus require training and pruning in order to establish a type of orchard tree which is easy to handle and which produces high yields of good quality fruit. In the majority of cases, training begins early in the life of a tree to avoid the production of a large amount of wood which must be removed later on.

Training Young Trees.

Young trees are usually headed before they leave the nursery and reach the grower with three or four evenly spaced branches, the lowest being approximately 18 inches above ground level. In training young trees, shoots developing inside the tree are removed while they are small to encourage the outward growth of what will become the permanent limbs. Buds developing on the trunk must be rubbed off as they break into growth. When trimming young trees, care should be taken not to over-expose the main limbs, as they are susceptible to sunburn. However, unwanted shoots should not be allowed to grow large.

Pruning Bearing Trees.

Pruning has several objects, the more important of which are:—(1) the continuous production of new wood—the best quality citrus fruits are carried on vigorously growing new wood; (2) the development of a symmetrical shape in the tree as an aid to orchard operations such as fumigation, spraying and cultivation; (3) to keep the trees within manageable size—oversized trees are not economical as the yields do not compensate for the extra time required for cultural operations and harvesting; and (4) to remove dead and aged wood.

The pruning of bearing trees varies a great deal according to variety, but it is generally necessary to keep the centre of the tree open with a canopy of bearing wood on the outside. Water shoots develop on the inside scaffold branches, especially on young trees, and these should be removed regularly.

So far as possible pruning should be done between harvesting and the subsequent blossoming. The several varieties are pruned in the order they mature their fruit, early varieties first and late varieties last. Summer pruning is seldom practised except in young non-bearing trees, but water shoots may be removed from the trunk and main scaffold at any time of the year.

Pruning Oranges and Grapefruit.

Oranges and grapefruit require very little pruning. Each season, however, dead wood is cut out together with some of the older growth on the under side and at the extremities of the fruit bearing branches. A light system of undercutting is desirable. The outside skirt of the tree should therefore be cut to about one foot from the ground and any protruding branches trimmed back.

Plate 109.

A Young Beauty of Glen Retreat Mandarin Tree After Pruning.

Pruning Mandarins.

Each variety of mandarin has certain peculiarities which require special consideration during pruning. The Glen Retreat habitually sets more fruit than the tree can carry and hand thinning of the fruit is always necessary. Heavy pruning in late winter reduces the crop to reasonable proportions and helps to maintain fruit size (Plate 109).

The Emperor has a pronounced upright habit of growth which, if unchecked, produces trees that are tall and difficult to handle. It is therefore necessary to cut back the top and shorten laterals to outward growing shoots. Fruit bearing branches should not be heavily thinned.

The Ellendale is pruned lightly, only old and dead twigs being cut out. In order to minimise the tendency of the trees to split longitudinally where the branches fork, side branches should be encouraged in preference to those on the top or bottom of the limbs.

Scarlet, Burgess, Fewtrell and Waratah mandarins are pruned in the same way as oranges.

Pruning Lemons.

Lemons require heavy pruning every year. A vigorous tree sends out a number of long shoots from the fruiting branches. If left unpruned, these bear fruit and the tree becomes straggly and is difficult to spray. These shoots must be headed back each year to well developed laterals. Pruning also involves a moderate thinning of aged wood and the lifting of the skirt of the tree to about 18 inches from the ground. In the centre of the tree, several well spaced laterals should be encouraged. Normally the strong sucker shoots on the inside scaffold branches should be completely removed, but at times one or more may be used to replace a dead branch.

Plate 110.

A Washington Navel Orange Skeletonised to Rejuvenate the Tree.

Renovation of Old Trees.

As a tree ages, vegetative growth diminishes, branches die back and a reduced yield of small fruit is harvested. In trees of this kind, the main arms can be cut back to wood of one inch and more in diameter, only a few of the healthiest laterals being retained (Plate 110). One season's crop will usually be lost by this method, but larger yields of better quality fruit can be expected in subsequent years.

Protection from Frost.

Areas particularly susceptible to frost will be avoided in selecting the site for an orchard, but in certain seasons odd frosty nights occur even in the best citrus districts. Young trees may be severely damaged by frost but can be protected by wrapping the trunks with straw, hessian or paper up to and including the lower branches.

Green manure crops or heavy weed growth in an orchard obstruct air drainage and accentuate frost injury. It is therefore necessary in cold areas to plough under any surface vegetation by early winter. Frost injury is also reduced by keeping the soil moisture at a relatively high level during the danger period.

When establishing an orchard, Ellendale mandarins or oranges which show some resistance to frost should be planted on the lower slopes and the highly susceptible lemons (Plate 111) on the higher land. Trifoliata rootstock imparts frost tolerance to all varieties worked on it.

Plate 111.

Frost Damage to a Lemon Tree Carrying a Full Crop of Mature Fruit.

PLANT NUTRITION.

Most of the soils selected for a citrus orchard contain sufficient plant foods to meet the requirements of the trees during the first year or two after planting. From then on it may be necessary to fertilize, the mixtures and quantities used depending on the condition of the soil

and the age of the tree. Citrus trees generally require relatively large amounts of nitrogen but only small quantities of phosphorus and potash. Therefore, unless a soil is known to be deficient in either of these last two elements, fertilizer mixtures rich in nitrogen will prove the most effective.

In spring, tree growth is rapid (Plate 112) and an abundant supply of plant food is needed. To provide this an application of a complete fertilizer is made in late winter; the components of the mixture used should be in an available form. In all parts of Queensland, the bulk of the annual rain falls in late summer (January-February) and much of the soluble plant foods in the soil is leached out of the root zone of the tree. Losses of this kind are replaced by a fertilizer application in late summer. In the poorer soils, nitrogen deficiency symptoms such as yellowish-green leaves and weak twig growth may appear in late spring and can be remedied by applying a nitrogenous fertilizer about late November.

Plate 112.
An Eight-Year-Old Late Valencia Orange Tree.

The following fertilizer programme for citrus may be taken as a guide to orchard practice:—

Late Winter (July).—An 8 : 10 : 8 or similar mixture at the rate of 1 lb. per tree per year of age, with a maximum of 10 lb. (that is, a 6-year-old tree would receive 6 lb. and a 15-year-old tree 10 lb.).

Late November.—Sulphate of ammonia or other straight nitrogen fertilizer at the rate of ½ lb. per tree per year of age, with a maximum of 5 lb.

Late Summer (following heavy rains).—A 10 : 8 : 7 or similar mixture at the rate of ½ lb. per tree per year of age with a maximum of 5 lb.

In certain districts, magnesium deficiency causes a bronzing of the leaves and premature leaf-fall. Leaves remaining on the tree become pale yellow around the margin, leaving a triangular shaped green area along the midrib. Yield is depressed and fruit size reduced. This condition is usually corrected by soil dressings of both dolomite and magnesium sulphate (Epsom salts). The dolomite should be applied first at a rate of 1 to 1½ tons per acre and the magnesium sulphate later at a rate of up to 5 lb. per tree.

Lime or dolomite can profitably be used in most orchards to correct excessive acidity in soils with a pH lower than 6·0, which is the optimum for citrus. The quantities applied vary from one to two tons per acre according to the prevailing pH and soil texture. Heavy soils will require more lime to effect a change than light ones with the same pH. An immediate response to the treatment seldom occurs, but liming is usually associated with better tree health and high yields.

Trace Elements.

Zinc is the most commonly deficient trace element in citrus soils, the outstanding symptom being mottle-leaf or foliocellosis. This disorder is readily controlled by a foliage spray containing zinc sulphate 10 lb., soda ash 3¾ lb. (or hydrated lime 5 lb.), and water 100 gallons. The spray is best applied in early spring in combination with the petal-fall copper spray used for the control of fungous diseases. If necessary, it can also be combined with either an oil spray or a sulphur spray later in the season. In healthy orchards an annual treatment with a half-strength spray will normally prevent the appearance of zinc deficiency symptoms, but should mottle-leaf reappear, the full strength formula will need to be used for at least one application.

Boron deficiency is difficult to diagnose as symptoms vary somewhat with the variety of citrus. Generally, the veins of the leaves exhibit a corky appearance and vegetative growth is substantially reduced. The fruit is 'nobbly,' with brown areas under the rind and many imperfectly formed seeds. To correct the deficiency, powdered borax may be added to the soil at a rate of 6 oz. per tree for fully matured trees and a smaller quantity for younger trees. Larger amounts than these must not be used as excessive boron in the soil is injurious. One soil dressing every third year should meet normal requirements. Boron can also be absorbed through the leaves and an annual application of a spray containing 5 lb. borax per 100 gallons will correct mild deficiency symptoms. Borax will combine readily with most of the spray materials commonly used on citrus trees.

Terminal dieback, bushy tip growth and a gummy encrustation on the twigs are the usual symptoms of copper deficiency (Plate 113). This trouble only occurs where copper sprays are not used regularly for the control of fungous diseases. Should deficiency symptoms appear,

copper sulphate (granulated bluestone) should be applied to the soil at the rate of up to 1 lb. per tree according to age. This should be evenly spread over the whole land surface.

Plate 113.

A Young Tree Showing Symptoms of Copper Deficiency.

Organic Matter in the Soil.

The organic matter in the soil largely determines the availability of nutrients to the tree. One of the best methods of providing organic matter is the application of farmyard manure to the orchard, but quantities of 10 tons or more per acre are required to exert any appreciable effect. These quantities are not usually available and the only practical alternative is to grow cover crops. Where water supplies permit, a quick growing annual plant such as cowpea can be grown between the trees. The crop is usually sown from October to December and turned in from March to May, when the summer rains have ended and the danger of erosion passed. Winter cover crops (Plate 114) are not generally used in citrus orchards as they tend to interfere with harvesting operations.

In localities where orchards are not irrigated, it should be practicable to grow crops such as pigeon pea or elephant grass outside the orchard and spread the green material among the trees each spring. The surface mulch supplied to the soil in this way materially assists in conserving soil moisture. Wherever possible the crop grown should be a legume.

Plate 114.

A Cover Crop in a Young Citrus Orchard. New Zealand blue lupin is frequently grown as a winter crop among young trees, but winter cover cropping is seldom practised in a bearing orchard.

SOIL MOISTURE AND IRRIGATION.

Many orchards are successfully managed without irrigation. Nevertheless, even in districts with a good natural rainfall, the installation of an irrigation system would safeguard the trees during stress periods, significantly increase yields and improve the quality of fruit.

If an adequate supply of water is not available at the time of blossoming, fruit setting will be poor. Ample soil moisture is also necessary when the fruit is approaching maturity. When the tree is developing a crop, it must not be allowed to wilt and regular examinations of the soil moisture in the root zone are therefore necessary. This is best done with a soil auger or spade, which should be sunk to three or four feet or more, according to the texture and depth of the top soil. The zone of greatest root concentration is usually between the depths of one and three feet. Irrigation should be commenced when the soil in this zone shows signs of drying out in several sample holes dug in the orchard.

The amount of water applied depends on the texture of the soil and the depth of penetration required. On irrigating, the moisture content of the surface soil is immediately raised to field capacity but the depth of penetration depends on the amount of water applied. Soil below the saturated zone will not be affected at all. Therefore, one must know the amount of water required to saturate the soil either down to the bottom of the root zone or to the already moist layer underneath. In heavy soils, a much greater quantity of water is required to wet a foot of soil than in light sandy soils. The quantity required in any orchard can only be ascertained by actual tests.

The rate of application will be determined by the nature of the surface soil and the method of application used. If water is applied faster than the rate of absorption, it will accumulate on the surface and cause soil wash. Light soils generally absorb water more readily than heavy soils, but much depends on the condition of the surface soil. An over-cultivated soil may crust badly and resist the penetration of water, whereas soil with a trash cover or a green manure crop permits the free entry of water.

In most Queensland citrus orchards, spray irrigation (Plate 115) is used but flood irrigation is practicable on heavier soils with a slight slope. Spray irrigation gives the more even distribution of water throughout the orchard and permits better control of the amount of water used. On the other hand, the initial cost of equipment is high. There are many spray irrigation systems and most of them use portable pipe lines with connections at approximately 24 ft. intervals. A recent development is the high pressure nozzle with a comparatively wide surface coverage which under calm conditions operates efficiently.

In flood irrigation, the basin system is frequently employed. Ridges are thrown up around each tree to form the basin and water is run from a head drain on the highest side of the orchard through a line of trees. As each basin fills, the supply is stopped back. The furrow system employs a number of parallel furrows, usually about four, running between the trees. Water is led into the upper ends of these furrows from a main ditch and allowed to gravitate to the other end. This system is suitable for use in orchards planted on almost level land but the land must be carefully graded to avoid scouring on the one hand or water accumulation on the other.

Plate 115.

Spray Irrigation of Citrus at Gayndah.

Drainage.

During periods of heavy rainfall the roots may become water-logged in comparatively shallow soils with disastrous effects on the trees. If water reaches the orchard from higher land, a diversion bank must

be constructed to intercept and conduct it away from the trees. Within the orchard, surplus water must be removed by installing sub-surface drains which may be either open or closed. Such drains must be given a sufficient fall to maintain the free flow of water to the outlet outside the orchard area.

CULTIVATION METHODS.

Clean cultivation has been the normal orchard practice in Queensland for many years although it depletes the soil of organic matter, causes deterioration in structure, and accelerates erosion. The greater the depth and the more frequent the cultivation, the greater the damage. Generally, cultivation should be only deep enough to incorporate the weeds with the surface soil, and only practised at times when heavy falls of rain are not expected. Where the soil moisture can be regulated by irrigation, a reasonably safe procedure is to cultivate the orchard in early winter and sow a cover crop in late spring. The cover crop may be turned in during late summer.

HARVESTING AND PREPARATION FOR MARKET.

When citrus fruits are removed from the tree, they do not ripen in storage as do some other fruits, even though the yellow skin colour may develop. Harvesting of the crop should begin, therefore, when the fruit is fully mature and reasonably palatable.

Round nosed clippers should be used to remove the fruit from the tree and the attached stem should be cut short to avoid damaging other fruit. Pulling the fruit tends to injure the stem end and provides a point of entry for storage rots. Fruit should always be handled carefully, placed gently in picking tins or bags and never dropped or thrown into containers.

Plate 116.

A Modern Citrus Packing Shed at Gayndah.

Sweating.

It is customary to hold fruit for at least seven days after harvesting before packing (Plate 116). During this period, rots will develop on any damaged fruit and these can then be culled satisfactorily. Sweating also allows the rind to contract before packing, and the risk of shrinkage in transit to market and the associated troubles of loose packs are reduced to a minimum.

Colouring.

As a general rule, the early varieties are artificially coloured, while mid-season and late maturing varieties are allowed to develop full colour on the tree. Colouring greatly enhances the appearance of lemons, grapefruit and navel oranges. Only mature fruit should be treated; colouring may give immature fruit a good appearance but it only builds up buyer resistance to the product and gives both the grower concerned and the district a bad reputation.

Colouring involves holding the fruit in gas-tight chambers and introducing acetylene or ethylene gas into the room. There are no set dimensions for colouring rooms and various designs are in use. Moderate sized chambers approximately 6 x 6 x 6 feet are better than one large one. When loading the fruit into the chamber, the cases are stacked with a small space between them in order to allow free circulation of the gas.

The quantity of gas is determined by the volume of the room. With ethylene, special gauges are used to measure the prescribed dosage from a cylinder, but with acetylene the required amount of calcium carbide is weighed out and treated with a surplus of water. Carbide is normally used for colouring citrus fruit in Queensland. The quantity required varies somewhat with the variety of fruit. Navel oranges are easily damaged by acetylene and 1 to 1½ oz. of carbide will produce a sufficient concentration of gas for each charge in a chamber of 200 cu. ft. capacity. Grapefruit require 4 to 6 oz. and lemons 12 to 16 oz. Immature fruit is slow in colouring, does not develop a brilliant final shade and is highly susceptible to gas burn.

In colouring, no regular system of recharging is followed. Sometimes, the chambers are sealed and charged with gas for four hours, opened and allowed to air for two hours. In other cases, they are charged only once in 24 hours, the gas being held overnight for 10 to 12 hours and the room aired for 12 to 14 hours. From eight to 12 chargings may be necessary to develop full colour in the fruit.

Temperature influences the rate of colouring, the best range being 65° F. to 75 °F., although higher temperatures are not usually detrimental.

SCHOOL FOR ADULT PINEAPPLE GROWERS.

A school for adult pineapple growers will be held on the North Coast from 26th to 28th May, inclusive.

In announcing this, the Minister for Agriculture and Stock (Hon. H. H. Collins) said that the decision to hold the school for purely adult growers had been reached following the success of the schools for junior pineapple growers conducted by the Department.

The school will take the form of a series of field days at the Department's Maroochy Experiment Station at Nambour, and on pineapple farms in the Mary Valley and Beerwah-Glasshouse districts. Specialist officers of the Department will deliver addresses on modern methods of pineapple culture, management, and harvesting, on soil conservation, soil deficiencies and weed control. The addresses will be supplemented by practical demonstrations.

The Minister added that growers should benefit considerably from this instruction in latest methods of pineapple growing.

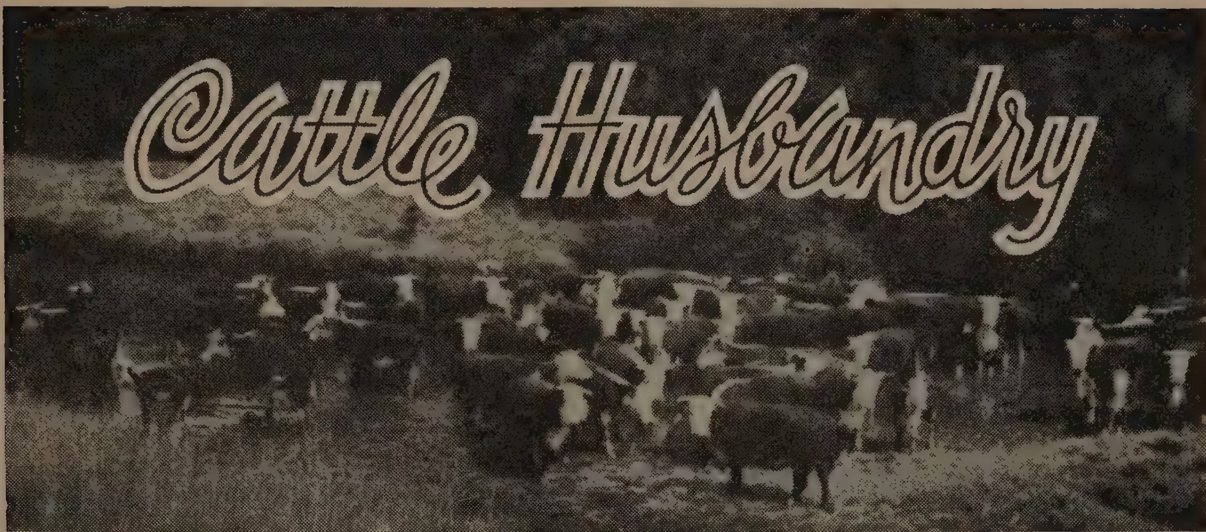
TUBERCULOSIS-FREE CATTLE HERDS.
(AS AT 21st MARCH, 1952.)

Breed.	Owner's Name and Address of Stud.
Aberdeen Angus	The Scottish Australian Company Ltd., Texas Station, Texas F. H. Hutton, "Bingegang," Dingo
A.I.S.	F. B. Sullivan, "Fermanagh," Pittsworth D. Sullivan, "Bantry" Stud, Rossvale, *via* Pittsworth W. Henschell, "Yarranvale," Yarranlea Con. O'Sullivan, "Navillus Stud," Greenmount H. V. Littleton, "Wongalea Stud," Hillview, Crow's Nest J. Phillips and Sons, "Sunny View," Kingaroy Sullivan Bros., "Valera" Stud, Pittsworth Reushle Bros., "Reubydale" Stud, Ravensbourne H. F. Marquardt, "Chelmer," Wondai W. G. Marquardt, "Springlands," Wondai A. C. and C. R. Marquardt, "Cedar Valley," Wondai A. H. Sokoll, "Sunny Crest," Wondai
Ayrshire	L. Holmes, "Benbecula," Yarranlea J. N. Scott, "Auchen Eden," Camp Mountain "St. Christopher's and Iona" Studs, Brookfield Road, Brisbane E. Mathie and Son, "Ainslie" Ayrshire Stud, Maleny
Friesian	C. H. Naumann, "Yarrabine Stud," Yarraman J. F. Dudley, "Pasadena," Maleny
Guernsey	C. D. Holmes, "Springview," Yarraman
Jersey	W. E. O. Meier, "Kingsford Stud," Rosevale, *via* Rosewood J. S. McCarthy, "Glen Erin Jersey Stud," Greenmount J. F. Lau, "Rosallen Jersey Stud," Goombungee G. Harley, Hopewell, Childers Toowoomba Mental Hospital, Willowburn Farm Home for Boys, Westbrook F. J. Cox and Sons, "Rosel" Stud, Crawford, Kingaroy Line R. J. Browne, Hill 60, Yangan P. J. L. Bygrave, "The Craigan Farm," Aspley A. Verrall and Sons, "Coleburn Stud," Walloon R. J. Crawford, "Inverlaw Jersey Stud," Inverlaw, Kingaroy P. H. F. Gregory, "Carlton," Rosevale, via Rosewood E. A. Matthews, "Yarradale," Yarraman A. L. Semgreen, "Tecoma," Coolabunia G. & V. Beattie, "Beauvern," Antigua, Maryborough L. E. Meier, "Ardath" Stud, Boonah A. M. and L. J. Noone, "Winbirra" Stud, Mt. Esk Pocket, Esk

A SPECIAL RADIO SERVICE FOR FARMERS

★ ★ ★

The COUNTRY HOUR, a special service for farmers, is broadcast DAILY through the National and Regional Stations from 12 to 1.



Portable Calf Bails.

A. HUTCHINGS, Senior Adviser, Cattle Husbandry Branch.

SICKNESS and mortality in calves commonly result from infection caused by contaminated feeding premises and utensils.

Infection from calf yards, bails and feeding facilities can be largely eliminated by the use of portable calf bails. They are very useful for individual calf feeding where rotational practices are carried out, as they can be changed from paddock to paddock with the calves. Infection which often surrounds fixed feed structures is thus avoided.

The portable bails described in this article were designed and built by Messrs. Brown Brothers, Rosewood, from a Departmental plan for fixed bails. The bails accommodate 14 calves. Smaller ones could be built according to the number of calves being reared. Wheels are attached at one end and wooden skids at the other end of the framework. Hardwood timber was used in the construction of the bails, which are so heavy that some difficulty is experienced in shifting the structure by hand. Provision could be made for transport by horse or tractor by fastening a chain, strong wire, or iron bolt to one end. Lighter timber could be used to facilitate moving.

Construction.

Overall dimensions are 8 ft. 9 in. long, 4 ft. 6 in. wide, and 3 ft. 6 in. high. A 2-ft. feed-path divides the two rows of bails. The corner posts and struts dividing the individual bails are 3 ft. 6 in. x 3 in. x 1½ in. All these struts are bolted at top and bottom between 2 in. x 1 in. runners 8 ft. 9 in. long. The floor, 1 ft. from ground level, is made of ½ in. slatted timber running lengthwise. Partitions between bails are of similar slatted timber. The ends of the framework are bolted by 2 in. x 1 in. timber top and bottom, braced for strength and slatted as for the partitions. A light gate is hinged at one end of the feeding path.

Sword sticks of 2 in. x 1 in. timber pivot on bolts at the base and with a 5 in. clearance from the strut. Each is secured in position by a small iron peg which is inserted through a hole bored through the stick and cross member. For convenience, the pin is permanently suspended on the cross member.

Each bail is 15 in. wide, 15 in. deep, 2 ft. 6 in. high and 1 ft. from ground level.

For nipple feeding a 3 in. x 1 in. board is bolted along the inner side of the bails 2 ft. from ground level. Inch holes are bored for inserting the rubber teats opposite the middle of each bail. The bottom edge of the milk bucket rests on a rail at the floor level of the bails and the handle hooks over a nail on the teat supporting board, to keep the bucket upright. Calves syphon the milk when sucking through strong rubber tubing reaching to the bottom of the bucket.

Where nipple feeding is not practised, the floor of the bails would be better only 6 in. from ground level and the milk bucket placed on the slatted floor. Dry feed is placed in buckets or half drums resting in the bail.

Plate 117.

Portable Calf Bails on the Property of Brown Bros., Rosewood.

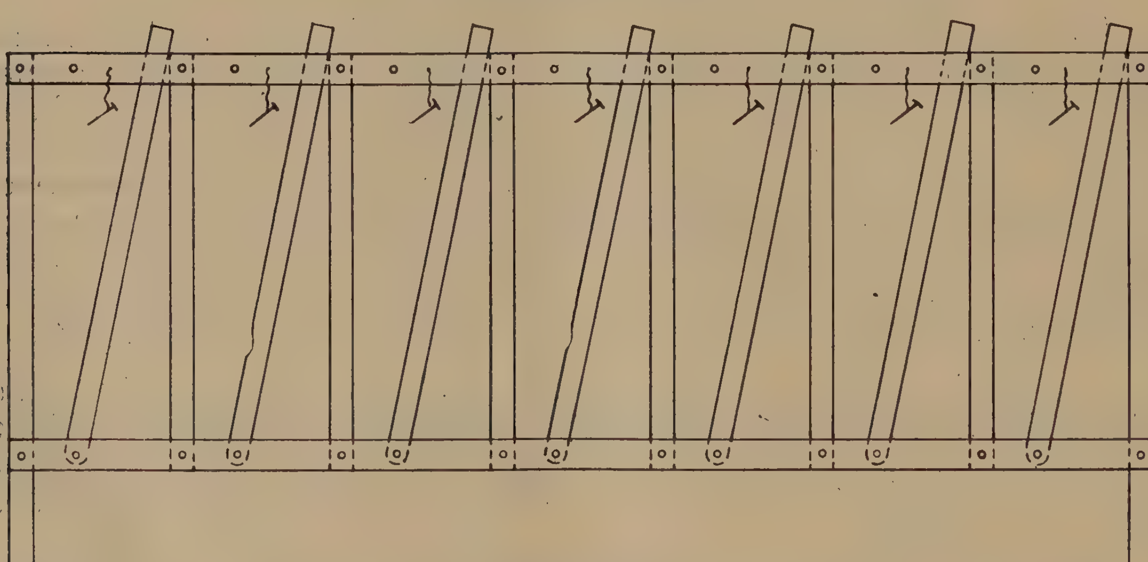


Plate 118.

Sketch of Side of Portable Bails, Showing Sword Sticks.

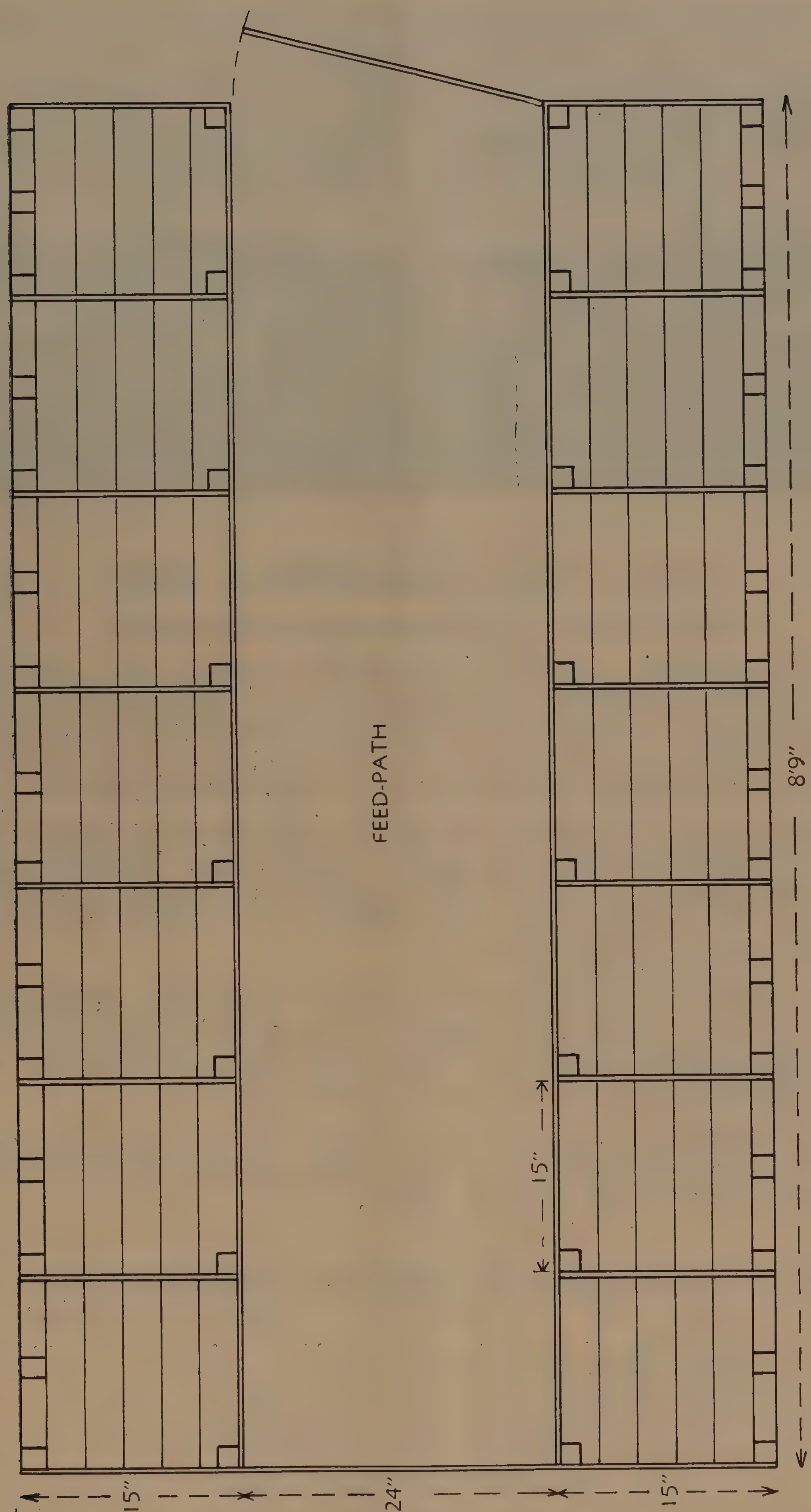
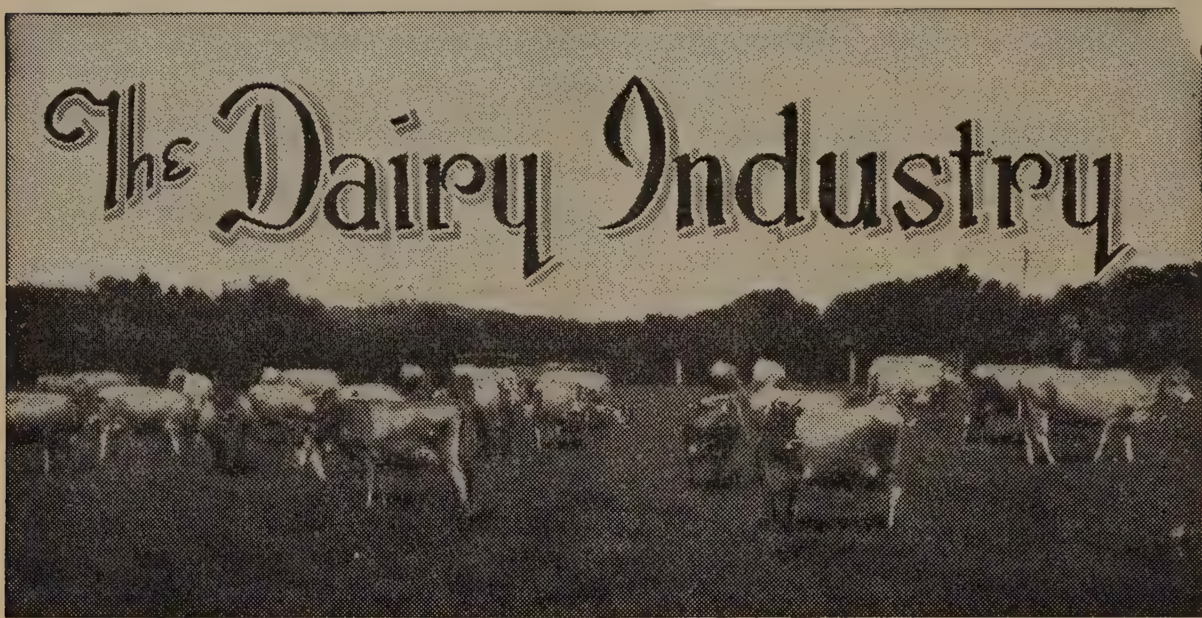


Plate 119.

Ground Plan of Portable Bails.



Dairy Farm Competition, 1951.

R. A. PAUL, Director of Field Services, Division of Dairying.

THE competition reported here is the second such competition conducted by officers of the Department of Agriculture and Stock and financed from the Commonwealth Dairy Industry Efficiency Grant, the other having been finalised in the previous year. No entry fee was charged, the competition being open to all bona fide dairy farmers.

Each entry was judged twice by the same panel of judges drawn from the Divisions of Animal Industry and Dairying. The first judging took place between the date of closing of entries (January 1, 1951) and April 30, 1951, whilst the second judging was carried out between August 1 and November 30, 1951.

The dairying areas of the State were divided into 16 zones, but due to insufficient entries in some of the zones it was necessary to amalgamate some to ensure adequate competition. Finally 11 zones were defined and these are shown in Plate 120.

The judging schedules were divided into five main sections as shown below and these were further subdivided into 50 sub-sections with a view to obtaining uniformity between judges.

		Points.
Section A.	Pastures, Crops, Soil Fertility, Fodder Conservation	1,000
Section B.	Farm Layout, Buildings, Equipment, Milking Methods	840
Section C.	Dairy Herd Management	950
Section D.	Farm Economy	600
Section E.	Animal Feeding (including Pig Raising)	610
	Total	4,000

Entries received totalled 104 but due to adverse seasonal conditions during the greater portion of the year 23 farmers withdrew after the first judging.

Plate 120.

Sketch Map Showing Boundaries of Competition Zones.

The prizes awarded in each zone were:—

First—£50 and Trophy.
Second—£30 and Pennant.
Third—£20 and Certificate.

For the competition under review a handicap system was adopted whereby prize winners in the previous competition were penalised 80 points for first, 40 points for second and 20 points for third, and these are shown in the list of prize winners.

LIST OF PRIZE WINNERS.

Zone.	Entrant.	Address.	Handicap.	Nett Points.
1 and 2	1. E. D. Lawley and Son	Maleny	..	3,208
	2. Est. A. Alcorn ..	Maleny	..	3,080
	3. F. J. Fleiter ..	Conondale	80	3,069
3 and 4	1. T. A. McNaught ..	Pound Hill, *via* Gympie ..	..	2,588
	2. F. H. Sippel ..	Redgate, *via* Murgon ..	40	2,538
	3. Allen and Sons ..	Chatsworth, *via* Gympie ..	80	2,468
5	1. T. J. Champney ..	Crawford, Kingaroy Line ..	..	2,626
	2. A. Royle	Coolabunia	..	2,614
	3. V. Voight	Crawford road, Booie ..	..	2,447
6 and 7	1. Muspratt and Sons	Littlemore	80	2,725
	2. Lehfeldt Bros. ..	Kalapa	80	2,680
	3. N. J. Larson ..	Thornhill street, North Bundaberg	..	2,675
8	1. G. E. Muller ..	Homebush road, Mackay ..	..	2,867
	2. W. Menkens and Son	Home Hill	80	2,568
	3. G. Cole and Sons ..	Alligator Creek	..	2,154
9	1. R. S. Griffiths ..	Moregatta	20	3,047
	2. H. Sigley	Jaggan	..	2,731
	3. Stephenson Bros. ..	Jaggan	..	2,655
10	1. H. L. Stark ..	Kalbar	..	2,955
	2. J. P. Schlecht ..	Lark Hill, *via* Walloon ..	..	2,821
	3. J. Egan	Fulham Vale, Toogoolawah	..	2,754
11 and 12	1. R. J. Browne ..	Yangan	80	2,951
	2. A. E. Pechey ..	Pechey	..	2,857
	3. P. J. Evans ..	Dragon street, Warwick ..	..	2,792
13 and 14	1. I. B. Skerman ..	Kaimkillenbun	40	2,954
	2. C. H. B. Huey ..	Sabine, Cooyar Line ..	20	2,885
	3. J. Schull and Sons	Oakey	..	2,772
15	1. B. J. Ostwald ..	Monto	80	2,885
	2. C. G. Luthje ..	Monto	40	2,561
	3. Mrs. A. A. Elliott	Monto	..	2,322
16	1. W. Lawrence ..	Dululu	40	2,783
	2. L. and A. Goos ..	Valentine Plain	..	2,666
	3. Leeke Bros. ..	Thangool	..	2,621

SECTION DETAILS.

Table 1 shows the average section points scored in each zone by the competitors, compared with the highest points gained by a farm (not necessarily a prize winning entry) in that zone. The figures indicate that there is need for considerable improvement by many of the farmers before the efficiency represented by the best in each section is achieved. It is pointed out that comparison between zones is extremely difficult because of the very many differences of soil and climate which exist.

Plate 121.

Pasture Paddocks on the Farm of Mr. F. J. Fleiter, Conondale.

Plate 122.

Hayshed and Adjacent Feeding Stalls on the Farm of Mr. F. J. Fleiter, Conondale.

Plate 123.

Mixed Paspalum and Kikuyu Grass Pastures on the Farm of Messrs. E. D. Lawley and Son, Maleny.

Section A. Pastures, Crops, Soil Fertility and Fodder Conservation.

The average score of all competitors was 63.9 per cent. of the maximum points allotted to the section. This can be regarded as a very fair effort, but the judges' reports indicate that greater attention could be paid to farm subdivision, soil conservation, maintenance of soil fertility, pasture management and, particularly, fodder conservation, with a consequent increase in efficiency.

A number of entrants scored high points in the section and worthy of special mention is the farm of Mr. F. J. Fleiter (Conondale), who was third prize winner in Zones 1 and 2. The home portion of this farm, comprising 266 acres, is subdivided into 27 paddocks which are laid down to or are in the process of being laid down to permanent pasture (Plate 121). The pasture species include red and white clover, perennial ryegrass, prairie, Rhodes and paspalum grasses. A number of these paddocks are irrigable if required, and in addition an irrigated 10-acre paddock of lucerne and 4½ acres of cowcane are grown. At the time of the first inspection, fodder conserved included 90 tons of lucerne hay in a shed (Plate 122) and 15 tons of grass and lucerne hay and 6 tons of millet in stacks in the field. At the time of the second inspection very little of this fodder had been utilised even after one of the driest winter and spring periods on record. Mr. Fleiter scored 86.5 per cent. of the maximum points.

A view of E. D. Lawley and Son's pastures of mixed paspalum and kikuyu grasses is shown in Plate 123.

TABLE 1.

Details of Section Points.

Zone.	—	Section A.	Section B.	Section C.	Section D.	Section E.
		Per cent.	Per cent.	Per cent.	Per cent.	Per cent.
1 and 2	Average Score ..	70·7	82·0	58·6	53·8	73·1
	Highest Score ..	86·5	90·7	75·5	83·7	85·6
3 and 4	Average Score ..	43·8	71·4	61·8	47·0	53·4
	Highest Score ..	58·3	89·9	75·2	67·5	62·8
5 ..	Average Score ..	60·6	65·5	54·9	31·0	51·0
	Highest Score ..	78·5	77·0	72·4	53·7	60·8
6 and 7	Average Score ..	65·9	83·3	60·7	29·7	70·0
	Highest Score ..	80·5	89·4	67·9	50·7	74·4
8 ..	Average Score ..	64·1	82·5	55·8	31·3	52·1
	Highest Score ..	79·1	90·1	69·9	42·3	56·1
9 ..	Average Score ..	69·7	74·3	61·7	54·2	60·3
	Highest Score ..	86·0	87·5	72·1	66·0	66·6
10 ..	Average Score ..	74·2	78·9	61·3	35·7	71·5
	Highest Score ..	83·0	84·5	72·0	49·5	78·4
11 and 12	Average Score ..	62·7	79·8	66·1	34·7	54·9
	Highest Score ..	83·5	91·3	82·6	42·5	84·1
13 and 14	Average Score ..	51·3	81·8	73·1	47·3	64·9
	Highest Score ..	70·7	92·3	87·1	52·3	83·9
15 ..	Average Score ..	60·6	68·2	55·7	42·7	50·3
	Highest Score ..	81·5	85·6	72·2	55·3	71·1
16 ..	Average Score ..	62·9	85·2	61·2	42·5	63·6
	Highest Score ..	76·0	89·6	71·8	50·5	68·9
All Zones	Average Score ..	63·9	76·9	60·8	40·3	61·6

Section B. Farm Layout, Buildings, Equipment and Milking Methods.

The average points score in this section was 76·9 per cent., a very satisfactory position. Reports indicate that provision of shade, shelter and water supply points, and location and standard of dairy and farm buildings are suitable. Equipment generally is ample and adequate, well kept and housed, while animal feeding facilities, shed routine and milking methods are of a high standard.

Section C. Dairy Herd Management.

It will be seen from the table that the average point score in this section was 60.8 per cent., which is interpreted as only a fair performance. The information furnished shows that the commercial dairyman is aware of the importance of the herd sire from the breeding angle; of the 129 bulls owned by entrants, 94 per cent. were registered purebred animals. Unfortunately, no less than 40 per cent. of these animals had no record of production backing either on the near male or

the near female side. This could be a reflection on the studmasters as evidence of their reluctance to avail themselves of testing facilities, or alternatively of their previous practice of submitting to test only a selected portion of the herd.

There appears to be laxity with some entrants in relation to herd identification and service control. Over one-third of the entrants failed to exercise any control over mating, allowing the bull to run with the cows at all times. Herd health in most cases was excellent and preventive measures were adopted where necessary.

Cow production figures generally were disappointing, the average being 173 lb. of commercial butter. Of the 81 entrants, 19 had an average exceeding 200 lb., 8 exceeding 250 lb. and 2 over 300 lb. C. Huey, Sabine, the second prize winner in zones 13 and 14, averaged 315 lb. commercial butter with his registered Jersey herd of 41 cows. This herd is headed by a sire with very good production backing. Mr. Huey has practised line breeding for many years and recently has brought a young bull from Victoria to intensify the line. Services are strictly controlled, all cattle identified and a complete record kept of service and calving dates. All cows are given a dry period of six weeks and are "steamed up" prior to calving. Stock are T.B. and C.A. tested and all reasonable precautions are taken to keep the herd disease free.

Plate 124.

Portion of the Friesian Herd of Mr. H. L. Stark, Kalbar, Which Averaged 308 lb. Commercial Butter for the Year.

H. L. Stark, winner in zone 10, has a herd of 30 registered Friesian cows (Plate 124), all dehorned, which averaged 308 lb. commercial butter. Full details of service and calving dates are recorded, stock are identified and adequate disease control precautions are taken.

Section D. Farm Economy.

Points in this section were allotted for production per acre, labour cost and efficiency of keeping farm records. The average score of 40.3 per cent. is low and is due almost entirely to the poor scoring for production per acre. Labour cost per lb. of commercial butter is generally low and farm records are good.

The average production per acre for all competitors was 23 lb. commercial butter. Seven entrants had a production over 50 lb., five over 75 lb. and one over 100 lb. The Estate A. A. Alcorn, second prize winner in zones 1 and 2, headed the list with 114 lb. per acre, while the winners in the same zones (E. D. Lawley and Son) had a production of 96 lb. per acre. These farms are situated close together at Maleny and have a number of features in common. There is no cultivation on either farm and both have excellent pastures of kikuyu, paspalum and white clover. Both properties are very well subdivided into 5-8 acre paddocks which are systematically grazed, harrowed, renovated and topdressed with lime and superphosphate.

Section E. Animal Feeding (including Pig Raising).

The section applies mainly to young stock management and pig raising and the average score was 61.6 per cent.

The judges' remarks show that the provision of more grazing paddocks for female replacements rather than the all too common "calf paddock" is very necessary for the raising of healthier stock. Due attention is paid to the time of mating virgin heifers, and subsequent care and treatment appear adequate.

In most cases satisfactory pig accommodation is provided and good type breeding stock are kept, but better utilisation of available skim milk is indicated as judged from the number of pigs sold from the farms.

Cows per Acre and Production.

Table 2 gives a summary of the average number of acres and milking cows in each zone compared with those of the winning farm, together with the average production per acre and per cow.

The figures in brackets indicate the highest production figure obtained in each zone.

The average figures for all zones are given at the end of the table.

In the table the number of acres represents the area used for dairying and is not necessarily the whole area of the farm, while the number of cows is the total of cows milking and dry on the farm during the period of the competition. As pointed out earlier, there are very significant differences between zones. The table shows that average carrying capacity varies from 4.5 acres per cow in zones 3 and 4 to as much as 10·8 acres in zones 13 and 14. Average production per acre ranges from 15 lb. commercial butter in zones 6 and 7 to 45 lb. in zone 9 and per cow production from 109 lb. in zone 8 to 210 lb. in zone 9.

GENERAL.

It is pleasing to be able to report that interest is growing in the Dairy Farm Competitions, as evidenced by the greatly increased number of entries received in the current competition. There is quite definite evidence from the judges' reports, from large attendances at field days held on some of the prize winning farms, and from personal contact with farmers in widely separated areas that much benefit is being derived by the dairy farming community, as a result of the competition, which will result in increased efficiency.

TABLE 2.

Zone.		Acres.	Cows.	Acres.	Production (lb. Commercial Butter).	
				Per Cow.	Per Acre.	Per Cow.
1 and 2	Average	418	85	4·9	35	171
	E. D. Lawley and Son	143	60	2·4	96 (114)	228
3 and 4	Average	296	66	4·5	36	159
	T. A. McNaught ..	80	30	2·6	83	222 (250)
5	Average	390	42	9·3	19	182
	T. J. Champney ..	149	42	3·5	66	228
6 and 7	Average	587	64	9·1	15	138
	Muspratt and Sons ..	987	120	8·2	15 (28)	124 (173)
8	Average	356	52	6·8	16	109
	G. E. Muller	120	33	3·6	48 (55)	174
9	Average	319	68	4·7	45	210
	R. S. Griffiths ..	217	63	3·4	77	266
10	Average	244	40	6·1	32	200
	H. L. Stark	160	30	5·3	58 (62)	308
11 and 12	Average	222	38	5·8	30	175
	R. J. Browne	160	22	7·2	36 (68)	262
13 and 14	Average	694	64	10·8	18	203
	I. B. Skerman ..	776	53	14·6	20 (40)	296 (315)
15	Average	790	76	10·3	18	189
	B. J. Ostwald ..	385	64	6·0	39	234
16	Average	756	71	10·6	16	171
	W. Lawrence	470	48	9·8	25	241 (273)
All Zones	Average	464	61	7·6	23	173

The Value of Continuous Recording of Dairy Herds.

C. H. CLARK (Dairy Officer, Herd Recording) and S. E. PEGG (Senior Adviser, Herd Recording).

THE recording of dairy herds, in accordance with Group Herd Production Improvement Scheme, was commenced in 1948, the first herds being recorded early in that year. In October, 1948, there were 16 herd recording groups in operation and 316 herds were recorded. It is now possible, after two years of recording, to assess the effect of continuous recording on herds in the 16 groups situated in various parts of the State.

The production of herds which were recorded for two years—1948-49 and 1949-50—was compared with the production of herds recorded in 1949-50 only. Comparisons of herds were made on production figures derived from completed lactations in 1949-50. The average production of cows completing lactations in 1949-50, in the 154 herds recorded for two years, was 3,651 lb. milk and 162 lb. butterfat, while

the average production of cows completing lactations in 1949-50, in the 151 herds recorded for one year, was 3,529 lb. milk and 152 lb. butterfat. Cows in herds which were recorded for two years produced 112 lb. milk or 10 lb. butterfat more than cows in herds recorded for one year only. This information is shown in Table 1.

TABLE 1.

1949–50 PRODUCTION OF HERDS IN THE SIXTEEN GROUPS CONSIDERED.

——	No. of Herds.	No. of Cows.	Average Milk.	Average Fat.
			Lb.	Per Cent.
Recorded for one year ..	151	5,180	3,529	152
Recorded for two years ..	154	6,507	3,651	162

It is seen that the average cow in herds recorded for two years produced 12·2 lb. commercial butter more than the average cow in herds recorded for one year only. The price of commercial butter during the period under discussion was 2s. 2d. per lb., so farmers who recorded for two years received an average of £1 6s. 5d. per cow more than farmers recording for one year.

By recording continuously, farmers have a regular check on the production performances of individual cows and are able to determine those which combine the five qualities sought in sound dairy cows—namely, sound milk and butterfat production qualities; fertility (ability to calve regularly); resistance to disease (sound constitution); length of working life; good milking temperament. They also have a continuous check on their systems of feeding, breeding and management and are able to assess from year to year the value of various changes in husbandry.

Herd improvement is a long range project which should be approached by farmers in the following manner—

The first year tests the farmer.
The second year tests the herd.
The third year culls the herd.
The fourth year builds the herd.
The fifth year proves the bull.

CHANGE OF ADDRESS.

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Address all communications to the Under Secretary, Department of Agriculture and Stock, Brisbane.

Vital Statistics and the Queensland Sheep Industry.—Part 1.

G. R. MOULE, Director of Sheep Husbandry.

THE majority of records kept by woolgrowers are those required for taxation purposes, but valuable information is contained in the statistical returns forwarded by woolgrowers to the State Government Statistician at the end of March each year. Although these appear to consist merely of bald statements dealing with the number of sheep, the losses and the lambings in any flock, the figures can be used to assess the industry's welfare on an arithmetical basis. It is the purpose of this and subsequent articles to acquaint woolgrowers with the procedures followed and to present results obtained from a study of figures pertaining to the Queensland sheep industry.

WHAT ARE VITAL STATISTICS?

It is well known that every birth and every death in a modern civilised community is duly certified by a responsible person. In addition, it is obligatory for doctors to report the occurrence of certain infectious diseases. Information of this type is extremely valuable to insurance companies which issue policies covering such diverse subjects as "the whole of life" or " the birth of twins." It is also an important indication of the extent to which our nation is fulfilling the destiny which Australians so proudly believe to be its lot. The collection of information about births, deaths and diseases is fundamental to considerations of the progress made by any population, whether it be human or animal. Figures of this type constitute what is commonly known as vital statistics.

The vital statistics of the sheep industry in Queensland are of considerable interest. They furnish information about the State's sheep population and the extent to which it has varied. They also reveal the rapidity with which the population has been rebuilt after severe drought losses have occurred, and the way in which these increases have been achieved. In addition to these gross differences, vital statistics can provide more detailed information about the state of the industry in different districts and even about different flocks. They have direct application to the sheep industry on the national level as well as from the point of view of the individual producer. Besides being a useful guide to property owners to trends in their own flocks, a study of vital statistics can throw light on the performance of the studs from which rams are procured.

Today's concept of applied genetics is based on knowledge of the breeding performance of animals, and the progress which might be expected from following any animal breeding plan is partly dependent upon the vital statistics of the flock being considered.

HOW CAN VITAL STATISTICS BE USED IN SHEEP BREEDING?

Woolgrowers in Queensland know only too well that it is important to try to save the young ewes when a drought occurs, because they can be used to rebuild a depleted flock. Young ewes have the whole of their breeding life ahead of them. Losses associated with lambing will be less than in older ewes, and there is a chance that they will raise more lambs to marking age than old sheep. These three factors are important in determining the rate at which a flock rebuilds after drought losses and it is worth considering them in some detail.

The average length of the breeding life of a flock of ewes depends upon the number of times they are mated and the average number of ewes lost each year from natural causes, such as lambing and fly strike. Suppose a flock of 1,000 ewes is mated during five consecutive seasons and that, on an average, 10 per cent. of the ewes are lost each year from natural causes. This average figure may not represent the exact losses in any one year because the losses amongst old ewes are often heavier than those amongst younger age groups, but over the breeding life of a flock it might be quite a fair figure. The relationship between the number of ewes available for mating and the number lost each year is shown in Table 1.

TABLE 1.

Mating.	Number of Ewes Available for Joining.	Number of Sheep Lost = 10 per cent. Flock Joined.
First	1,000	100
Second	(1,000 — 100) = 900	90
Third..	(900 — 90) = 810	81
Fourth	(810 — 81) = 729	73
Fifth	(729 — 73) = 656	66
Totals ..	4,095	410

This means that from the original flock of 1,000 ewes, 4,095 matings have been obtained and each ewe has been mated on an average 4·095 times (obtained by dividing 4,095 x 1,000). While older ewes may be capable of further reproduction, the majority of woolgrowers would prefer to cast a ewe for age not later than the end of the fifth breeding season. Casting for age depends upon lamb-marking percentages and death rates, and their connection can be easily demonstrated.

Let us consider that two men each take up a selection and that each buys 1,000 rising two-tooth ewes, which are bred each year for the ensuing five years. Suppose 40 per cent. of lambs are marked to ewes mated each year on one property, while 54 per cent. of lambs are marked on the second. Suppose also that 16·5 per cent. of the sheep on the first property are lost through natural causes each year and 11 per cent. on the second property. The composition of the ewe portion of each flock after five years' breeding is shown in Tables 2 and 3 and in Figure 1. These have been constructed by calculating yearly losses and subtracting them from the flock totals at the commencement of each year, as is shown in Table 1. The percentage of lambs marked has been calculated on the number of ewes mated at the commencement of each year, and the young ewes have been mated to lamb during their second

TABLE 2.

CHANGES IN FEMALE SHEEP NUMBERS IN A FLOCK WITH AN AVERAGE LAMB-MARKING PERCENTAGE OF 40 AND AN AVERAGE DEATH RATE OF 16·5 PER CENT.

Age Group.	Commencement of— 1st Year.	2nd Year.	3rd Year.	4th Year.	5th Year.	6th Year.	7th Year.
				ON THE SELECTOR'S PROPERTY.			
Ewe Weaners ..	..	167	139	139	135	132	130
Over 1-year-old ..	1,000	..	139	116	116	113	111
Over 2-year-old ..	..	835	..	116	97	97	94
Over 3-year-old ..	..	..	697	..	97	81	81
Over 4-year-old ..	..	..	..	582	..	81	68
Over 5-year-old ..	..	..	..	..	486	..	68
Over 6-year-old ..	..	..	..	..	..	406	..
Over 7-year-old ..	..	..	..	..	..	..	339
Total ..	1,000	1,002	975	953	931	910	891

TABLE 3.

CHANGES IN FEMALE SHEEP NUMBERS IN A FLOCK WITH AN AVERAGE LAMB-MARKING PERCENTAGE OF 54 AND AN AVERAGE DEATH RATE OF 11 PER CENT.

Age Group.	Commencement of— 1st Year.	2nd Year.	3rd Year.	4th Year.	5th Year.	6th Year.	7th Year.
				ON THE SELECTOR'S PROPERTY.			
Ewe Weaners ..	..	240	214	241	261	284	308
Over 1-year-old ..	1,000	..	214	190	214	232	253
Over 2-year-old ..	..	890	..	190	169	190	206
Over 3-year-old ..	..	..	792	..	169	150	169
Over 4-year-old ..	..	..	..	705	..	150	133
Over 5-year-old ..	..	..	..	..	627	..	133
Over 6-year-old ..	..	..	..	..	..	558	..
Over 7-year-old ..	..	..	..	..	..	..	497
Total ..	1,000	1,130	1,220	1,326	1,440	1,564	1,699

year. The history of each group of ewes is shown by the figures on the diagonals. During the first year, 165 sheep were lost from the original 1,000 in Table 2. At the commencement of the second year there would be 835 sheep which had passed their second birthday.

It is apparent that at the commencement of the seventh year one ewe flock has decreased in size while the other has increased. It would be possible to cast a large proportion of the old sheep for age from the second flock at the end of the sixth year (that is, as rising 7-year-olds) without interfering very much with the strength of the breeding flock. Even if all the old ewes were cast for age the flock's strength would soon build up to 1,000 ewes again and thereafter it would be possible to cast all ewes after their sixth breeding season and cull the low producers amongst the young ewes as well.

Some of the advantages of culling young ewes are well known. One most important benefit is the immediate increase in the average productivity of the flock which results from the removal of the low cutters. Some measure of the extent to which culling will increase the cut per head of the remainder of the flock is indicated in Table 4, which was compiled by Mr. C. E. Young of "Noondoo," Dirranbandi, from records pertaining to stud sheep.

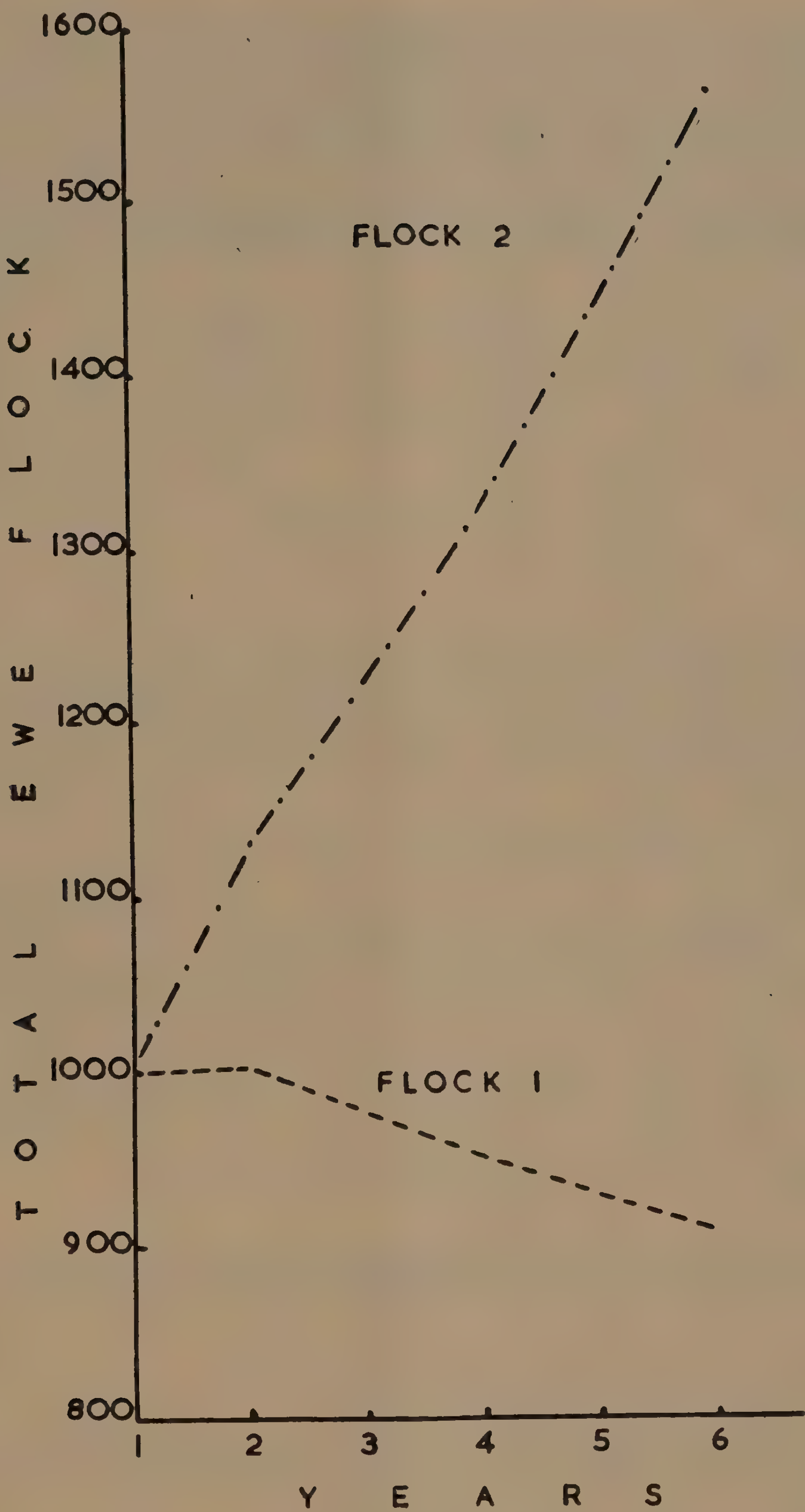


Figure 1.

Showing the way in which ewe flocks would increase over six years.

The vertical scale shows the total number of ewes in the flock and the horizontal scale shows the years.

The dotted line depicts the changes in flock No. 1 which experiences an average lamb-marking percentage of 40 and average annual death rate of 16.5 per cent.

The other line depicts the strength of flock No. 2 which has an average lamb-marking percentage of 54 and death rate of 11 per cent.

The strength of either flock can be determined for any year by erecting a vertical line from the point on the horizontal scale indicating the year in which interest is being taken. For instance, in the fourth year there would be about 950 ewes in flock No. 1 and a few more than 1,300 in flock No. 2.

TABLE 4.

EFFECT OF CULLING ON GREASY WOOL WEIGHTS CUT BY EWE FLOCKS.

(Average Greasy Wool-weight cut by Unculled Flock = 13 lb. 5 oz.)

Percentage of Ewes culled on Basis of low cut per Head.	Average Cut per Head of Proportion culled.	Average Cut per Head of Proportion classed into Flock.	Amount Cut per Head of those classed in is above the average of the unclassed Flock.
	lb. oz.	lb. oz.	lb. oz.
10	10 6	13 10	0 5
20	11 0	13 13	0 8
30	11 7	14 0	0 11
40	11 12	14 5	1 0
50	12 0	14 10	1 5
60	12 3	14 15	1 10
70	12 7	15 6	2 1
80	12 11	15 13	2 8
90	12 15	16 7	3 2

It should not be imagined that all of the gain in the cut per head which results from culling will be passed on to the offspring of the classed ewes. Only a proportion will be transmitted and this will depend partly upon the rams with which the ewes are mated. This will be dealt with in another article.

If Table 3 is continued it will be seen that if the ewes are cast for age after their sixth breeding season, then 9 per cent. of young ewes can be culled each year, and flock numbers will be maintained at about 1,000 ewes. This means, on the figures quoted in Table 4, that culling will increase the average cut per head of the sheep retained in the flock by a little under 5 oz. If it had been possible to increase the culling rate to 30 per cent., the average cut per head of the sheep retained in the flock would have increased from 13 lb. 5 oz. to 14 lb. In some flocks, culling at such a high level would produce a far greater increase in the average cut per head of the sheep classed into the flock, but culling rates are controlled by the way in which flocks reproduce.

WHICH VITAL STATISTICS MEASURE REPRODUCTION RATES?

Reproduction rates influence the amount of culling that can be done and it is well to consider this in some detail.

If an average ewe is mated five times in her life and if 60 per cent. of lambs are marked, she will rear three lambs from the five matings. About half of these lambs will be females and half males, so each two ewes produce between them three female lambs. Two of these will be required to replace their mothers when they are cast for age, and this leaves one ewe lamb to meet the losses experienced between marking and the age at which ewes are cast, as well as to meet the decreases in the ewe flock due to culling.

The losses within the flock are important for two reasons. It has already been pointed out that they influence the average number of breeding seasons obtained from ewes (see Table 1) and it also follows that where losses are high more sheep will be required as replacements.

Unfortunately very few data about the number of lambs born in a flock are available, as the first count is taken at lamb-marking time. Very often it is found that average losses in the flock are high when lamb-marking figures are low, and a good lambing percentage is

associated with low losses in the flock as a whole. This is unfortunate, because more young sheep are required as replacements in flocks which experience heavy losses. If the losses are expressed as a percentage, an easy way of determining the number of sheep which will be available at the end of each year is to subtract this average from 100. For instance, if the average loss is 10 per cent., at the end of the year, there will be (100—10) left from each 100 ewes present at the commencement of that year.

There is a mathematical connection between the amount of culling which can be done and the number of years ewes are bred, the lamb-marking percentage, and the average annual percentage death rate. It is expressed by the following formula:—

$$\text{Percentage of young ewes to be classed into the flock} = \frac{2{,}000{,}000}{\text{Average lamb-marking percentage} \times \text{Average number of years sheep are bred} \times \text{100 — average percentage annual loss}}$$

This formula is rather useful as it can also be used to calculate the number of times that the ewes should be bred to permit a given level of culling for certain lamb-marking percentages and average percentage losses, or it can be used to determine the lamb-marking percentages which will have to be maintained to permit certain levels of culling in a flock which experiences particular losses.

Suppose the following letters be used to represent the various factors being considered:—

S = percentage of young ewes to be classed into the flock,
M = the average lamb-marking percentage,
n = the average number of years sheep are bred,
d = the average percentage annual loss.

The formula then becomes

$$S = \frac{2{,}000{,}000}{M \times n \times (100-d)}$$

For the two selections considered in Tables 2 and 3, the percentage of young ewes that should be selected to maintain flock numbers can be calculated. The letter symbols and their respective values for the two selections are set out in Table 5.

TABLE 5.

VALUES ASSIGNED TO THE SYMBOLS FOR AVERAGE LAMB-MARKING PERCENTAGE, AVERAGE ANNUAL LOSS AND THE NUMBER OF OCCASIONS THE EWES ARE BRED ON TWO SELECTIONS.

Factor.	Letter Symbol.	Value for First Selection.	Value for Second Selection.
Lamb-marking percentage	M	40 (*see* Table 2)	54 (*see* Table 3)
Average number of matings per ewe after five joinings ..	n	3·6 Obtained from applying the method shown in Table 1 to the figures in Table 2.	4.014 Obtained from applying the method shown in Table 1 to the figures in Table 3
Average annual loss ..	d	16·5 (*see* Table 2)	11 (*see* Table 3)

For the first selection the value of S would be found by writing in 40, 3·514 and 16·5 for M, n and d respectively.

$$S = \frac{2,000,000}{40 \times 3{\cdot}6 \times (100-16{\cdot}5)} \%$$

$$= \frac{2,000,000}{40 \times 3{\cdot}6 \times 83{\cdot}5} \%$$

$$= 166\%$$

This means that the flock on this selection cannot maintain itself as more sheep have to be selected at classing time than actually exist!

It is seen by extending Table 3 that, even if the survivors of this flock are bred on 11 occasions, an average of only 5·225 matings is obtained from each ewe. If this value for n is used instead of 3·6 in the above workings, an answer of 115 per cent. is obtained. That means that even if the ewes are kept until they have attained their 13th birthday and if they are mated each year the flock will still be unable to maintain itself as more young ewes have to be selected than actually exist.

In practice, of course, the selector would mate the ewes as many times as possible and would probably obtain 4 or more matings every 3 calendar years. By doing this he would probably be able to maintain flock numbers.

On the second selection the value of S will be found by substituting 54, 4·014 and 11 for M, n and d respectively. The equation then becomes:—

$$S = \frac{2,000,000}{54 \times 4{\cdot}014 \times (100-11)} \%$$

$$= \frac{2,000,000}{54 \times 4{\cdot}014 \times 89} \%$$

$$= 104\%$$

It is clear, therefore, that this flock will almost maintain itself if no culling is undertaken and if the ewes are cast after attaining their sixth birthday (this is, after the flock has been joined four times). If they are kept for another year the average number of matings per ewe is increased from 4·014 to 4·57, and when this is substituted in the general formula, the value of S becomes 91 per cent. That is to say, 91 per cent. of the young sheep mustered at classing time have to be selected into the flock, or in other words, 100 — 91 (= 9 per cent.) of the young sheep can be culled. As this will result in a small increase in the average cut per head of the classed flock and as only a small portion of this increase will be transmitted to the offspring of the classed ewes, the owner of the flock may wish to increase his culling rate. Unless he can improve his husbandry practices to permit an increase in lamb-marking percentages, the main question confronting the woolgrower is the length of time he will have to hold his ewes in order to get sufficient matings to permit a 20 per cent. culling. This could be expected to increase by about ½ lb. per head the average cut of the ewes retained in a flock provided they are comparable to those shown in Table 4.

This can be determined by re-writing the formula

$$S = \frac{2,000,000}{M \times n \times (100-d)} \text{ as } n = \frac{2,000,000}{M \times S \times (100-d)}$$

If S is to have a value of 80, which is obtained by subtracting the culling rate of 20 per cent. from 100, the value of n will be found by simple multiplication and division to be 5·2. The number of years the ewes will have to be kept to obtain an average of 5·2 breeding seasons and allowing average losses of 11 per cent. will be obtained by re-writing Table 1 as shown in Table 6.

TABLE 6.

AVERAGE NUMBER OF BREEDING SEASONS PER EWE, ALLOWING 11 % ANNUAL LOSSES.

Year of Mating.	Number of Ewes Surviving. at Commencement of Year of Mating.	Total Number of Matings Achieved. by end of the Year.	Average Number of Matings per Ewe.
1st	1,000	..	..
2nd	890	1,890	1·890
3rd	792	2,682	2·682
4th	705	3,387	3·387
5th	627	4,014	4·014
6th	558	4,572	4·512
7th	497	5,069	5·069
8th	442	5,511	5·511

It is clear from Table 6 that if the ewes are mated once each year, they will be cast after they are about to attain the age of 10 years.

Under field conditions, the average number of times the ewes can be mated, assuming that seasonal conditions are satisfactory, is influenced by the losses which occur amongst the breeding ewes. If the death rate is high, fewer matings can be obtained from a line of sheep before they die. The influence of death rates is shown in Table 7.

TABLE 7.

PROGRESSIVE TOTALS OF THE NUMBER OF MATINGS THAT CAN BE OBTAINED FROM AN INITIAL FLOCK OF 1,000 YOUNG EWES WHICH SUFFER VARIOUS AVERAGE LOSSES, ASSUMING THE EWES ARE MATED ONCE PER YEAR.*

Age of Ewes in Years at Completion of Mating.	5 per cent. Loss.		10 per cent. Loss.		15 per cent. Loss.		20 per cent. Loss.	
	(1). Number of Ewes Surviving for Mating.	(2). Total Number of Matings Achieved.	(1).	(2).	(1).	(2).	(1).	(2).
2	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000
3	950	1,950	900	1,900	850	1,850	800	1,800
4	902	2,852	810	2,710	723	2,573	640	2,440
5	857	3,709	729	3,439	615	3,188	512	2,952
6	814	4,523	656	4,095	523	3,711	410	3,362
7	773	5,296	590	4,685	445	4,156	328	3,690
8	734	6,030	531	5,216	378	4,534	262	3,952
9	697	6,727	478	5,694	321	4,855	210	4,162
10	662	7,389	430	6,124	276	5,131	168	4,330

* The average number of matings per ewe at different ages can be obtained by dividing the progressive total in column (2) by 1,000.

These results have been used in drawing Figure 2, from which the number of times flocks experiencing various death rates have to be mated to secure various numbers of matings per head can be obtained.

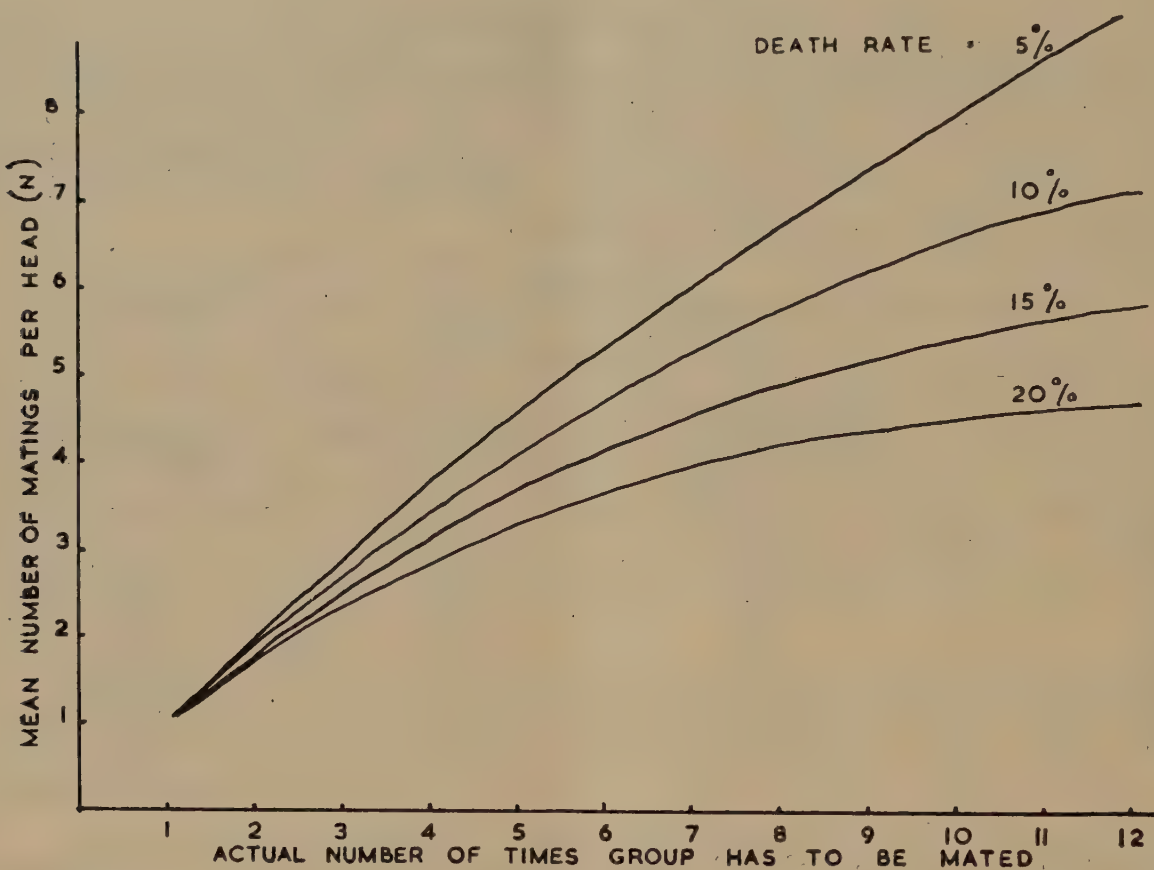


Figure 2.

Showing the average or mean number of matings obtained from each ewe in flocks which experience different percentage losses.

The horizontal scale shows the actual number of times the group is mated, and the vertical scale the average number of matings obtained from each ewe.

The curved lines consider the different average annual death rates; for instance, if the flock experiences an average annual death rate of 20 per cent. it has to be mated more than seven times to ensure that an average of four matings is obtained from each ewe. This result is obtained by drawing a horizontal line from 4 on the vertical scale and extending it until it intersects with the curved line marked 20 per cent. A vertical line is projected downwards from the point of this intersection until it cuts the horizontal scale.

The average losses and lamb-marking percentages influence the way in which sheep numbers are maintained. By giving S a value of 100 (that is, by allowing for the selection of all young sheep) and by multiplication and division, values for the number of times the ewes must be bred to ensure the maintenance of flock numbers for different lamb-marking percentages, after allowing for different percentage losses, can be calculated. Rather than present all the detailed results of these calculations, a graph has been drawn to show the connection and this is presented as Figure 3.

The age at which the ewes will be cast is presented in Figure 4. This has been drawn making allowance for different average losses and lamb-marking percentages, but permitting no culling (that is, all young sheep are classed into the flock).

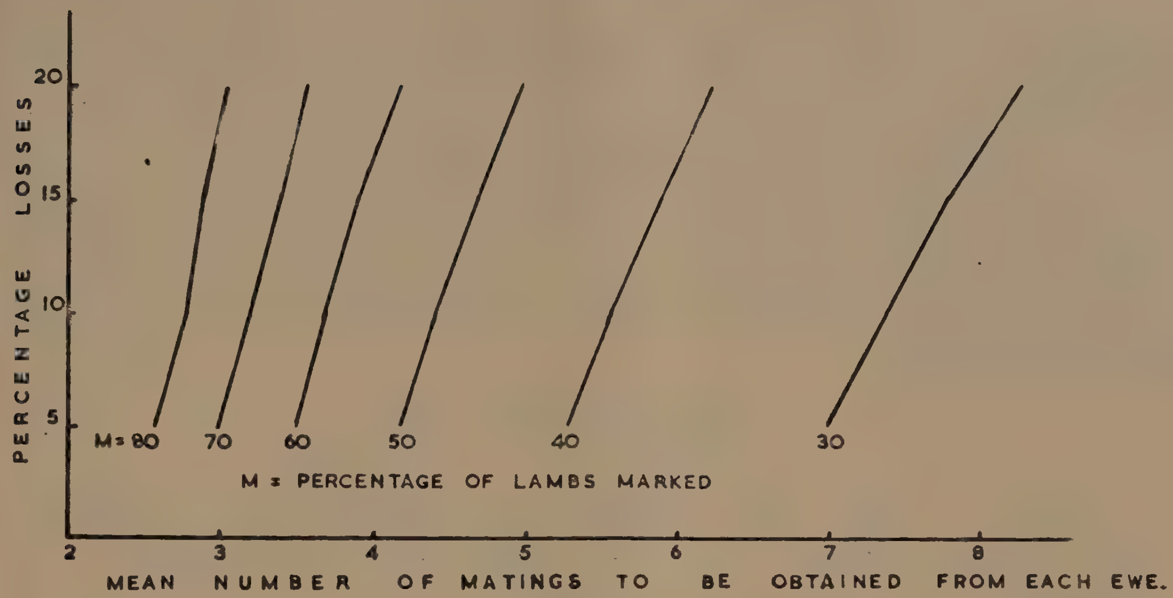


Figure 3.

Showing the average number of matings to be obtained from a ewe to maintain flock numbers, given different percentage losses and different lamb-marking percentages and allowing no culling.

The average annual percentage losses are shown on the vertical scale and the average number of matings to be obtained per ewe is shown on the horizontal scale. The sloping lines indicate the lamb-marking percentages. If the flock experiences an average annual loss of 20 per cent. and if the average lamb-marking percentage is 60, it would be necessary to secure an average of four matings from each ewe to ensure that the flock maintained itself. This information is obtained by drawing a horizontal line from 20 on the vertical scale until it intersects with the sloping line marked 60. A vertical line is dropped from this point of intersection until it cuts the horizontal scale at 4. By referring this result back to Figure 2 it is clear that the remnants of the original ewe flock would have to be mated on more than seven occasions to achieve an average of four matings per ewe.

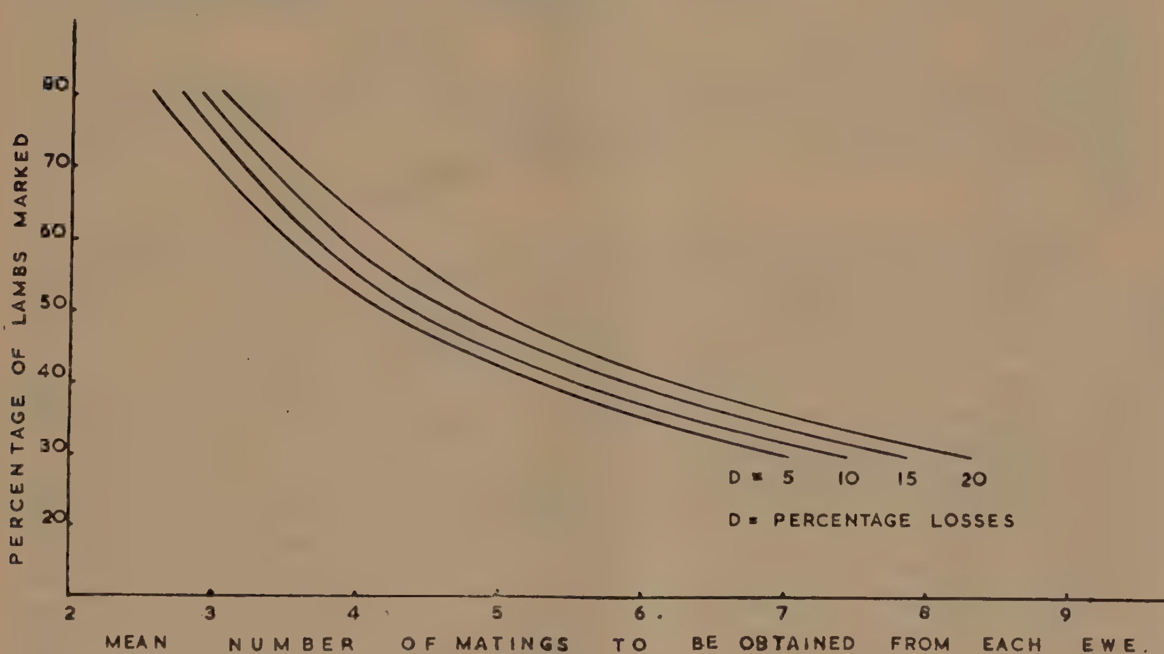


Figure 4.

Showing the average number of matings which must be obtained from each ewe to maintain flocks which experience different average lamb-marking percentages and different average percentage losses.

No allowance has been made for culling.

The vertical scale shows the lamb-marking percentages and the horizontal scale shows the average number of matings which must be secured from each ewe. The sloping lines show the different percentage losses.

This graph presents similar information to that presented in Figure 3. Although it is in a different form, it is used in the same way. That is, a horizontal line is drawn from a point on the vertical scale until it intersects with the appropriate sloping line; a vertical line is dropped from this point of intersection to meet the lower horizontal scale.

However, woolgrowers whose properties are in more favoured districts may be able to cull some sheep, and the problem confronting them pertains to the proportion of young sheep that can be culled, when the lamb-marking percentage, death rate and age at which ewes are cast are all known. This can easily be calculated from the formula $S = \frac{2,000,000}{M \times n \times (100-d)}$, and to save woolgrowers the trouble of making the detailed calculations, Figures 5, 6, 7 and 8 have been drawn to show the percentage culling which will allow the maintenance of flock numbers for different lamb-marking percentages, different losses and different ages for casting.

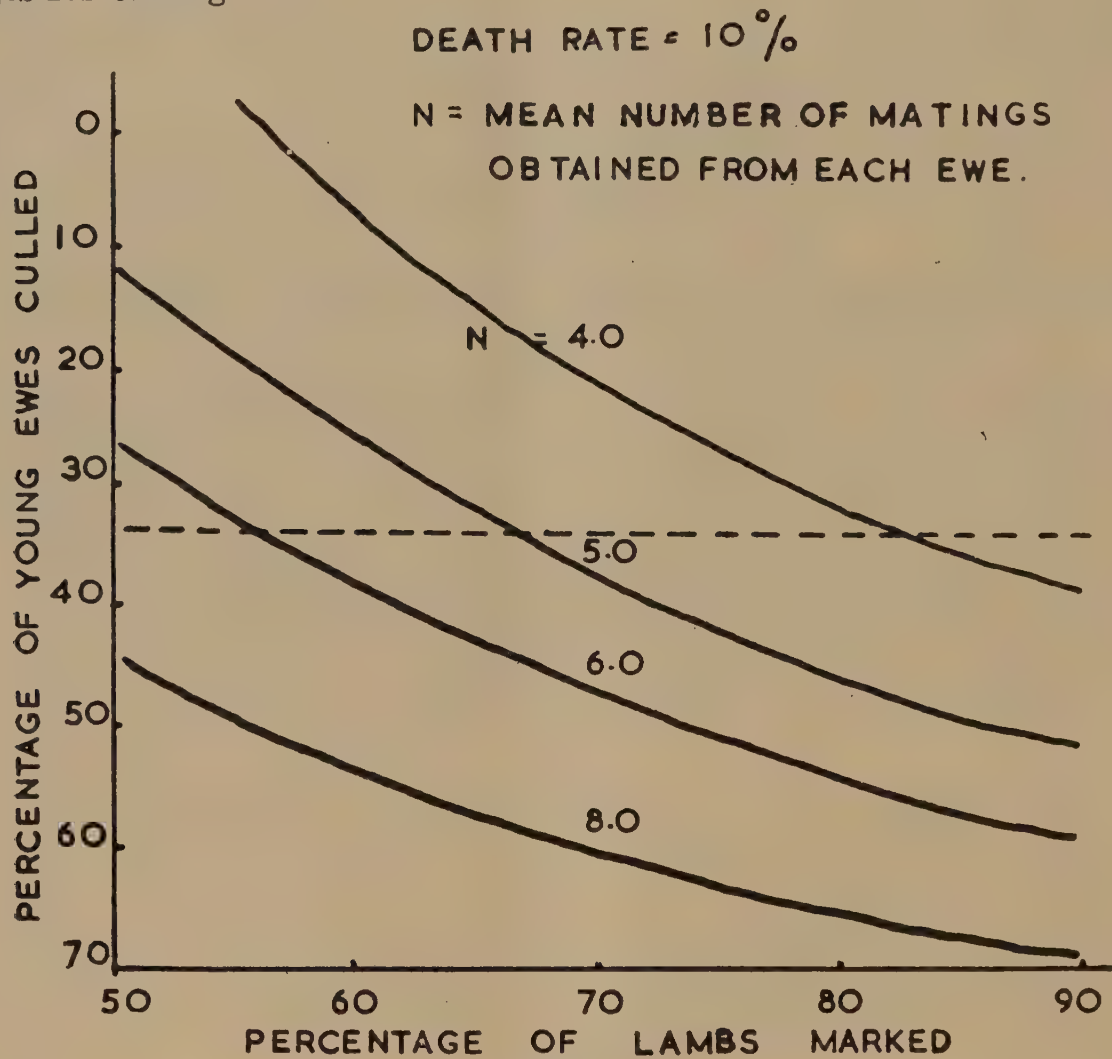


Figure 5.

Showing the relationship between the average lamb-marking percentages and the practical degree of culling.

The vertical scale shows the percentage of young ewes that can be culled and the horizontal scale shows the percentage of lambs marked. The sloping lines represent the average number of matings secured from each ewe. The dotted line shows a 34 per cent. culling. This can be practised and flock numbers will remain constant if:—

1. An average of six matings is obtained from each ewe (that is, if nine joinings are made, and the lamb-marking percentage is 57.5 per cent.).
2. If an average of five matings is obtained from each ewe (that is, if 6½ joinings are made, and the lamb-marking percentage is 67 per cent.).
3. If an average of four matings is obtained from each ewe (that is, if 5½ joinings are made and the lamb-marking percentage is 85 per cent.). The actual number of joinings required has been obtained from Figure 2.

This figure has been drawn allowing for an average death rate of 10 per cent.

Note.—The dotted line shows the maintenance of flock numbers with culling at 34 per cent.

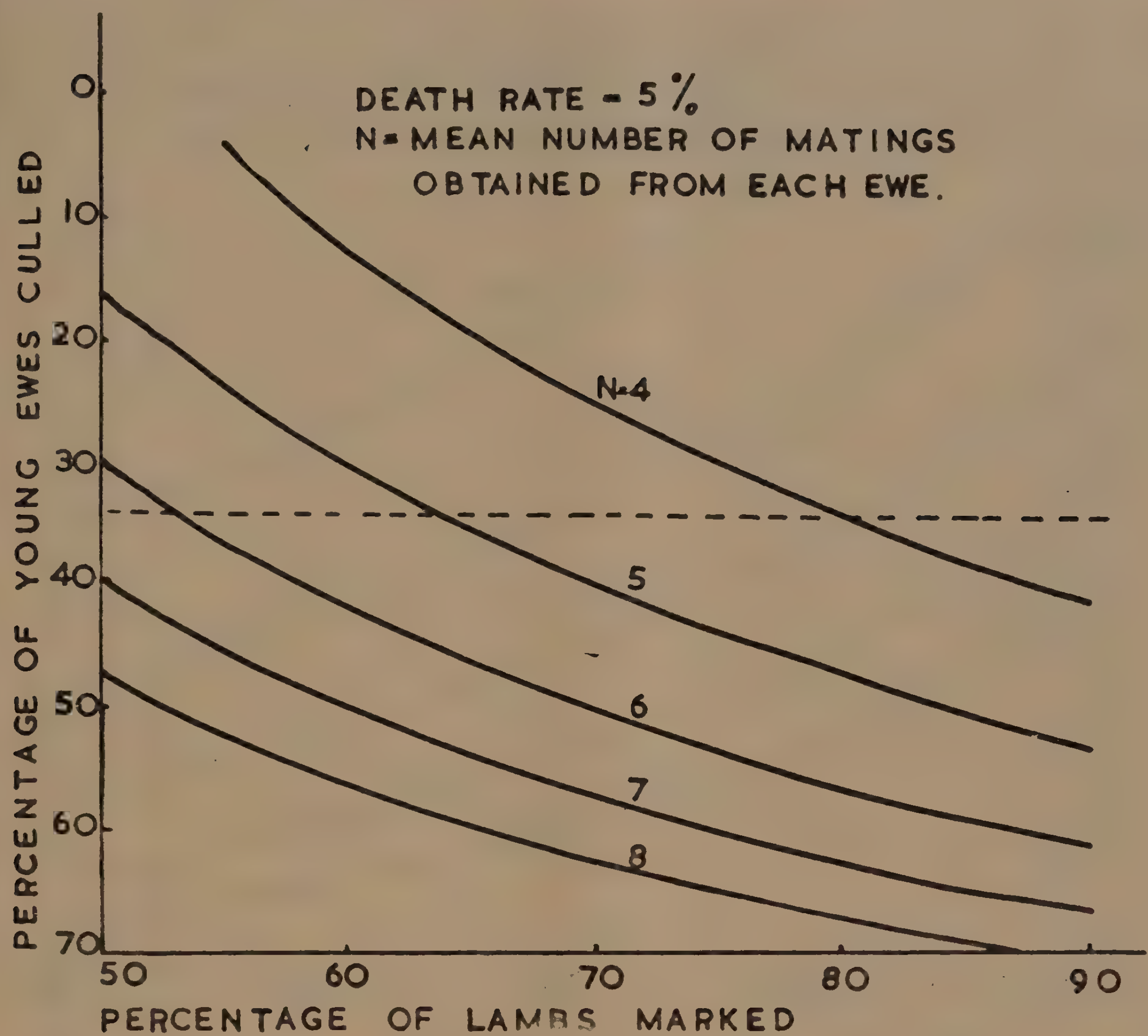


Figure 6.

Showing the relationship between the average lamb-marking percentage and the practicable degree of culling. This figure is similar to Figure 5 except that it has been based on an average death rate of 5 per cent.

Note.—The dotted line shows the maintenance of flock numbers with culling at 34 per cent.

HOW SHOULD DEATH RATES BE MEASURED?

Woolgrowers acknowledge that different death rates are recorded in their flocks depending upon their age and sex composition and the season. Some make a standard practice of writing off 2·5 per cent. of their breeding ewes and 1·25 per cent of their dry sheep every quarter. In addition, they write off a larger number of ewes if the female portion of the flock includes a lot of old sheep which lamb when seasonal conditions are adverse. Very often, however, the figures referring to death rates are quoted at a flat rate of 5 per cent. and 10 per cent. over the whole flock. These are known as crude death rates and can be quite misleading. In all the previous calculations the death rates have referred to ewes only.

It is preferable to record actual death rates on an age and sex basis. This permits a more accurate and detailed analysis of the ages at which losses increase and affords some indication of the causes of losses. An index known as the standard death rate can be computed from records kept on a sex and age basis and this can be used to compare losses amongst flocks in different districts. Obviously, the crude death rate can only be used for this purpose if the flocks under consideration have the same age and sex composition.

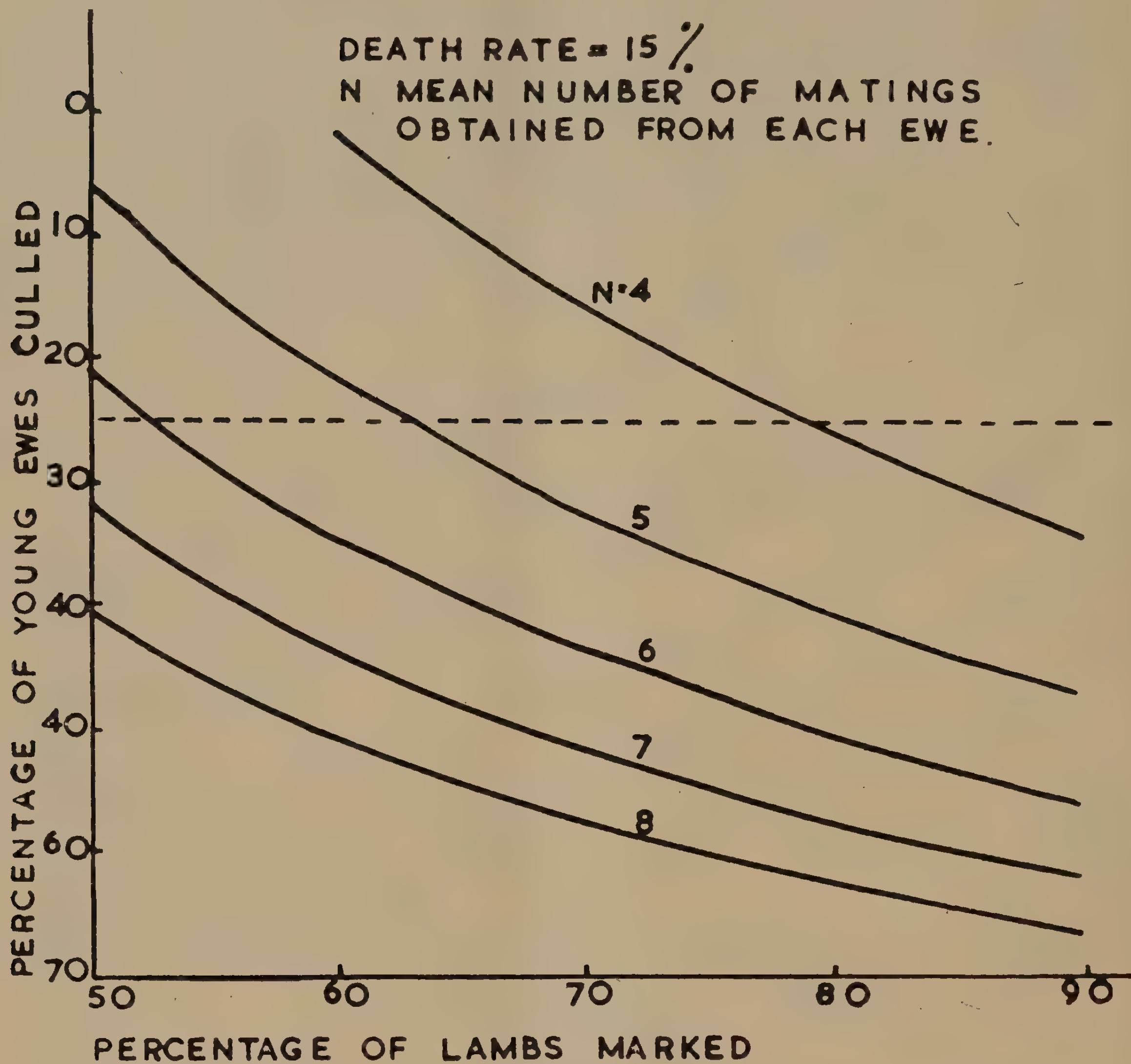


Figure 7.

Showing the relationship between the average lamb-marking percentage and the practicable degree of culling. This figure is similar to Figure 5 except that it has been based on an average death rate of 15 per cent.

Note.—The dotted line shows the maintenance of flock numbers with culling at 25 per cent.

HOW SHOULD LAMB MARKING PERCENTAGES BE CALCULATED?

Considerable discussion has taken place about the way in which lamb-marking percentages should be calculated, but the final decision must rest upon the purpose for which the figure is required. Those who are interested in animal husbandry in its widest sense will probably prefer to think in terms of lambs marked to ewes mated. This is influenced by

(1) The number of ewes which conceive during mating time.

(2) The number of ewes which die between the commencement of mating and lamb-marking.

(3) The fertility of the ewes (that is, the number of twins they produce).

(4) The lamb losses between birth and marking.

When consideration is extended to the classing of young sheep, losses in the classed and unclassed portions of the flock between marking and classing have to be considered. At classing time, young ewes which are old enough have to be selected to act as replacements for ewes which have been cast for age, as well as those which have been lost.

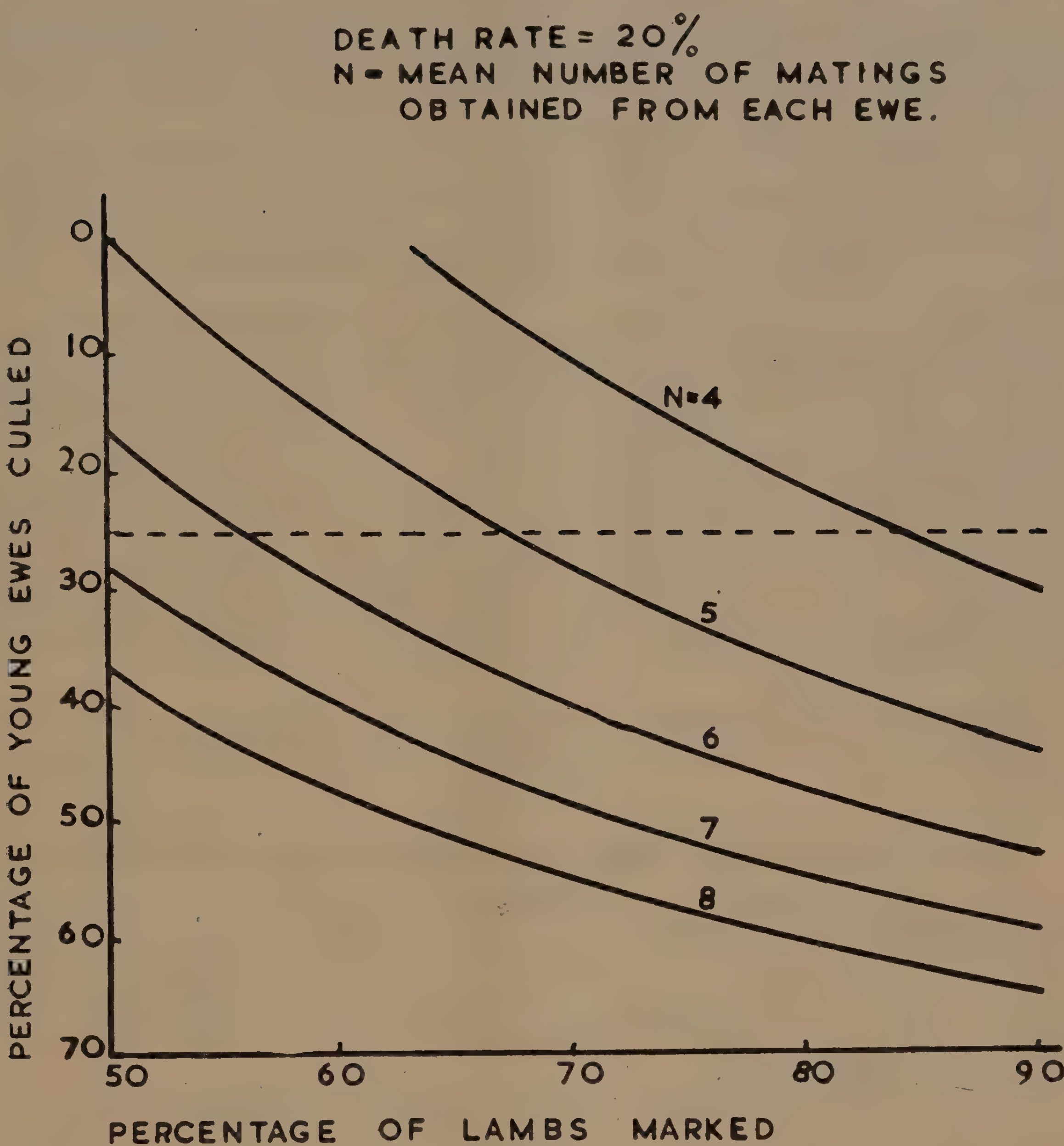


Figure 8.

Showing the relationship between the average lamb-marking percentage and the practicable degree of culling. This figure is similar to Figure 5 except that it has been based on an average death rate of 20 per cent.

Note.—The dotted line shows the maintenance of flock numbers with culling at 25 per cent.

If certain adjustments are made to the number of ewes in each age group depending upon their capacity to produce lambs, the number of young ewes which reach classing and hence breeding age can be expressed proportionally and this figure is known as the net reproduction rate. It differs from the gross reproduction rate, which for any one year is the average number of ewe lambs (that is, potential mothers) born to one ewe during the course of her reproductive life. This might be limited to the length of time she is in the flock and it is computed on the basis of her fertility rate, which depends upon the age of the ewe and the likelihood of her bearing twins. The gross reproduction rate does not take into account losses between birth and classing, but it can give a more accurate indication of conception rates than the net reproduction rate.

Woolgrowers frequently think in terms of the gross reproduction rate when they remark that 80 per cent. of lambs were marked from the 5-year-old ewes but that only 55 per cent. were marked from the maidens.

In the formula $S = \frac{2,000,000}{M \times n \times (100-d)}$; the lamb-marking percentage has been calculated upon the number of lambs marked to ewes mustered at lamb-marking time. This is done because consideration has already been given to the losses through the term (100—d), where d is the death rate.

Many woolgrowers use the percentage of lambs marked to ewes mustered in calculating lamb-marking figures, but it is as well to remember that the slightly flattering result which is obtained should always be considered in conjunction with the average annual losses. Lamb-marking percentages calculated in this way are used most frequently in calculations designed to throw light on the rate of genetic improvement in a flock. Provided the woolgrower realises it is the net reproduction rate which measures the rate at which his flock increases, it probably does not matter very much which method of calculating lamb-marking percentages he uses—each method has its advantages as well as its drawbacks.

One point is important, however. Lamb-marking records from different ewe flocks should be kept separate on the basis of the age of the ewes.

VITAL STATISTICS AND THE STUD SHEEP INDUSTRY.

Vital statistics are of importance to the studmaster because they indicate the number of sheep likely to be available for sale during any one year. The majority of studs have rams to offer for sale and the number will be dependent upon the size of the ewe flock mated, the lamb-marking percentages and the losses between marking and sale, as well as the culling rate.

Similar principles apply to the use of the available figures for computing the number of rams that might be for sale. For instance, suppose 1,000 stud ewes are mated and 66 per cent. of lambs are marked (to ewes mated). If the sex ratio is about 50 : 50, there will be 330 ram lambs. Annual losses between marking and sale may be as high as 10 per cent., so there will be about 296 ram lambs alive at the end of the first year. Even if no further losses occurred and if the rams were sold with their two teeth up there would only be 221 animals for sale after 25 per cent. had been culled. If they were sold as four-tooths and the 10 per cent. annual loss was maintained, there would be 266 available for classing and less than 200 for sale after a 25 per cent. culling.

These figures indicate the comparatively small number of sale rams produced by every 1,000 ewes mated.

Of far greater importance to the studmaster, however, is the effect of reproduction rates on the progress which can be made in stud breeding. This is influenced by the intensity with which the characters for which the sheep are selected are inherent, the average length of a generation and the degree of selection which can be practised. The degree of selection is dependent upon the lamb-marking percentages, losses and the number of years the sheep are bred, and its effects depend partly upon the difference between the performance of those selected and those animals which are culled.

The generation length is determined by the average age of the parents when the offspring are born, and for flocks which have low lamb-marking percentages this becomes rather long. In calculations to determine the efficiency of methods of selection, the generation length is divided into other factors. This means the greater the generation length becomes, the lower the efficiency of selection becomes, and this impedes the rate at which genetic progress can be made.

WHAT RECORDS SHOULD BE KEPT?

The considerations which have been mentioned raise questions as to the records that should be kept by woolgrowers. This will depend upon the purposes to which they are to be put and will vary from property to property and from district to district.

A complete set of data can be obtained from the counts usually taken on the average property where sheep breeding is practised, as these include:—

(1) The number of ewes in a paddock at joining time and the number of rams joined.
(2) The number of ewes in a paddock at end of joining time and the number of rams taken out.
(3) The number of ewes mustered for jetting, shearing or crutching prior to lambing.
(4) The number of lambs marked.
(5) The number of ewes mustered at marking time.
(6) The number of weaners mustered at weaning time.
(7) The number of ewes mustered at weaning time.
(8) The number of young sheep mustered for classing and/or shearing.
(9) The number of young sheep culled.
(10) The number and ages of the ewes cast for age.
(11) The losses amongst the rams on an age group basis, other than during mating.

At first sight this appears to be a lot of work but it is pointed out that counts of this nature are taken on the majority of properties and they are usually recorded in a field note book. All that is required then is to transfer these records onto a card or the page of a large book so the whole position can be seen at a glance. The value of the information is enhanced if age groups, dates and the name of the paddock in which the sheep were running are also recorded.

The ruling shown on pages 240 and 241 is suggested as being suitable. It could be made on a large sheet of white cardboard or in a book, where it can be kept as a permanent record.

Detailed information pertaining to the performance of individual animals may be available from studs in which records of ear-tagged ewes are kept.

If such detailed figures have not been kept, valuable information can be obtained by stud breeders if they keep information about:—

(1) The losses between lamb marking and first mating.
(2) The losses between each parturition on an age group basis.
(3) The fertility, expressed as lambs marked to ewes mustered at lambing time, on an age group basis.

These figures can be used to determine the breeding policy most likely to give an optimum rate of genetic improvement.

Type of Sheep.	JOINING.				MARKING.		WEANING.	
	Number of Ewes Joined, Date and Paddock.	Number of Rams Joined.	Number of Ewes when Rams Removed, Date and Paddock.	Number of Rams Removed.	Number of Ewes Mustered at Marking, Date and Paddock.	Number of Lambs Marked and Percentage.	Number of Ewes Mustered at Weaning Time, Date and Paddock.	Number of Lambs Weaned and Percentage.
Rams ..								
Lambs M								
F								
Weaners M								
F								
1 year M								
F								
2 years M								
F								
3 years M								
F								
4 years M								
F								
5 years M								
F								
6 years M								
F								
7 years M								
F								
8 years M								
F								
9 years M								
F								
10 years M								
F								
Mixed Ages M F								

CLASSING.		MULES OP'N.	SHEARING.	CRUTCHING.	JETTING.	DRENCHING.
Number of Sheep Mustered for Classing, Date and Paddock.	Number Culled and Percentage.	Number Treated, Date and Paddock.	Number Shorn, Date and Paddock.	Number Crutched, Date and Paddock.	Number Jetted, Date and Paddock.	Number Drenched, Date and Paddock.

Brucellosis Testing of Swine.

The Department of Agriculture and Stock is operating a scheme whereby pig herds are tested at intervals for the occurrence of swine brucellosis (contagious abortion).

A herd listed by the Department as "brucellosis tested" is one in which all such animals as may be determined by the Director of the Department's Division of Animal Industry have been subjected to two successive tests for brucellosis, at intervals determined by him, without any positive reactors being found.

In order for a herd to be retained on the list of Tested Herds, a semi-annual or annual re-test of the herd, as determined by the Director, is required. If at a re-test any animal gives a positive reaction to the test the herd is removed from the list; it is not listed again until subsequent tests, as determined by the Director, have been carried out.

Full particulars of the Brucellosis Testing of Swine and application forms may be obtained from the Under Secretary, Department of Agriculture and Stock, William Street, Brisbane.

TESTED HERDS.
(AS AT 21st MARCH, 1952.)

Breed.	Owner's Name and Address of Stud.
Berkshire	S. S. Ashton, "Scotia" Stud, Pittsworth
	J. J. Bailey, "Lucydale" Stud, East Greenmount
	S. Cochrane, "Stanroy" Stud, Felton
	Garrawin Stud Farm Pty. Ltd., 657 Sandgate road, Clayfield
	G. Handley, "Handleigh" Stud, Murphy's Creek
	J. L. Handley, "Meadow Vale" Stud, Lockyer
	R. G. Koplick, "Melan Terez" Stud, Rochedale
	H. V. Littleton, "Wongalea" Stud, Crow's Nest
	O'Brien and Hickey, "Kildurham" Stud, Jandowae East
	E. Pukallus, "Plainby" Stud, Crow's Nest
	G. C. Traves, "Wynwood" Stud, Oakey
	E. Tumbridge, "Bidwell" Stud, Oakey
	Westbrook Farm Home for Boys, Westbrook
	H. W. Wyatte, Rocky Creek, Yarraman
	H. M. State Farm, "Palen Creek," Palen Creek
	A. R. Ludwig and Sons, "Cryna" Stud, Beaudesert
	H. H. Sellars, "Tabooba" Stud, Beaudesert
	F. Thomas, "Rosevale" Stud, Beaudesert
	Bowkett and Meacle, "Myola Vale" Stud Piggery, Burra Burri, Jandowae
	D. T. Law, Trouts Road, Aspley
	R. J. McCullough, "Maxholm" Berkshire Stud, Gatton
	C. F. W. and B. A. Schellback, "Redvilla" Stud, Kingaroy
	R. H. Crawley, "Rockthorpe" Stud, *via* Pittsworth
	F. R. J. Cook, "Alstonvilla," Wolvi, via Gympie
	D. E. and E. C. Apelt, "Thelmur," Oakey
	Mrs. I. M. James, "Kenmore" Stud, Cambooya
Large White	H. J. Franke and Sons, "Delvue" Stud, Cawdor
	Garrawin Stud Farm Pty. Ltd., 657 Sandgate road, Clayfield
	F. L. Hayward, "Curyo," Jandowae
	J. A. Heading, "Highfields," Murgon
	K. B. Jones, "Cefn" Stud, Pilton
	R. G. Koplick, "Melan Terez" Stud, Rochedale
	R. Postle, "Yaralla" Stud. Pittsworth
	E. C. Smith, "Smithfield" Stud, Coomera
	E. J. Bell, "Dorne" Stud, Chinchilla
	A. G, Fry, "Birubi" Stud, Dalby
	N. E. Myers, Halpine Plantation, Kallangur

TESTED HERDS—continued.

Breed.	Owner's Name and Address of Stud.
Large White—*continued*	L. C. Lobegeiger, "Bremer Valley" Stud, Moorang, *via* Rosewood
	J. H. G. Blakeney, "Talgai" Stud, Clifton
	V. P. McGoldrick, "Fairymeadow" Stud, Cooroy
	N. Woltmann and Sons, Wooroolin
	R. S. Powell, Kybong, via Gympie
	E. B. Horne, "Kalringal," Wooroolin
	S. T. Fowler, "Kenstan" Stud, Pittsworth
	J. A. and J. McNicol, "Camden," Canning Vale, Warwick
Tamworth	S. Kanowski, "Miecho" Stud, Pinelands
	N. R. Potter, "Actonvale" Stud, Wellcamp
	D. F. L. Skerman, "Waverley" Stud, Kaimkillenbun
	A. C. Fletcher, "Myola" Stud, Jimbour
	L. C. Lobegeiger, "Bremer Valley" Stud, Moorang, *via* Rosewood
	Salvation Army Home for Boys, Riverview
	F. Thomas, "Rosevale" Stud, Beaudesert
	A. J. Surman, Noble Road, Goodna
	P. V. McKewin, "Wattleglen" Stud, Goombungee
	Department of Agriculture and Stock, Regional Experiment Station, Kairi
	P. V. Campbell, Lawn Hill, Lamington
	E. C. Phillips, "Sunny View," M.S. 90, Kingaroy
	T. A. Stephen, "Withcott," Helidon
Wessex Saddleback ..	W. S. Douglas, "Greylight" Stud, Goombungee
	K. Day and P. Hunting, "Kazan" Stud, Goodna
	E. Sirrett, "Iona Vale" Stud, Kuraby
	C. R. Smith, "Belton Park" Stud, Nara
	H. H. Sellars, "Tabooba" Stud, Beaudesert
	H. Thomas, "Eurara" Stud, Beaudesert
	D. T. Law, Trouts Road, Aspley
	G. J. Wilson, "Glenbella" Stud, Silverleigh
	G. J. Cooper, "Cedar Glen," Yarraman
	J. B. Dunlop, Acacia Rd., Kuraby

HAVE YOUR SEEDS TESTED FREE

The Department of Agriculture and Stock examines FREE OF CHARGE samples representing seed purchased by farmers for their own sowing.

The sample submitted should be representative of the bulk and a covering letter should be sent advising despatch of the sample.

MARK YOUR SAMPLE

Sample of .... seed
Drawn from .... bags
Representing a total of ....
Purchased from ....
Name and Address of Sender
Date......................

SIZE OF SAMPLE

Barley -	8 oz.	Oats -	8 oz.
Beans -	8 oz.	Peas -	8 oz.
Grasses	2 oz.	Sorghum	4 oz.
Lucerne	4 oz.	Sudan -	4 oz.
Millets	4 oz.	Wheat -	8 oz.

Vegetable Seeds - ½ oz.

SEND YOUR SAMPLE TO—**STANDARDS OFFICER, DEPARTMENT OF AGRICULTURE AND STOCK, BRISBANE.**

Protect Your Children Against Accidents.

PREVENTIVE medicine has saved millions of lives; it has enormously reduced infant mortality; it has practically eliminated many of the severer types of infectious disease such as typhoid, smallpox, malaria and more recently diphtheria. To go through a long list of its accomplishments would be tiresome. Railway executives surround the traveller with every safeguard; industrial executives protect employees by every possible means; national safety councils are held annually for the study of accidents and means of preventing them; everywhere "safety first" is the slogan of the day. In spite of all this, insufficient attention has been paid to the fact that children's lives are needlessly endangered in their own homes by certain classes of preventable accidents.

Causes of Accidents.

Recently a famous British authority on child health stated, "If the mortality figures for the 2 to 5-year-old group are examined it will be found that '*violence*' is responsible for *largest death rate.* For 1948 the rate per million from this cause was 372 for males and 244 for females, compared with 222 and 208 respectively for tuberculosis, 27 and 19 for diphtheria, 39 and 34 for measles and 50 and 24 for appendicitis. The 'violence' group can be subdivided into road-traffic accidents, which account for just under half of the total, and 'other violent causes,' which largely means burns and scalds."

Another frequent cause of injury and death in infancy and childhood is the swallowing or inhalation of foreign bodies. You would be surprised at the variety and nature of the objects which somehow manage to get stuck in a child's gullet or air passages.

Yet another fairly common cause of accidental death is drowning—often in the bath tub. The tragedy of it all is that the majority of these accidents are due simply to carelessness on the part of parents or nurse and most of them are entirely preventable. Think over those figures already quoted and realise that the lives of 99 per cent. of those little children should never have been endangered. If there had been a little more care and thought on the part of those in whose

care they were, they might all be alive and well to-day. It has been pointed out how very rare it is for a second case of severe burns to come to hospital from the same home, but what a tragically expensive way of learning the golden rule of "safety first." Far better to have a watertight "safety first" organisation in every home and family from the beginning. Do not rely on Providence and sit back in false security, for remember, the next victim may be *your* child.

Take, for instance, the question of accidents due to foreign bodies. Analysis of the causes in 3,449 cases of foreign bodies in the air and the food passages showed that in nearly 90 per cent. the presence of the intruder was due to easily avoidable carelessness—carelessness in the preparation of foods; carelessness in eating and drinking; carelessness in putting inedible objects in the mouth; carelessness of parents and nurses.

Prevention.

Now what can be done to prevent these tragic occurrences? There are many protective measures that can be taken—here are some of them:—

1. Foods for children should not contain such things as bones, water-melon seeds, orange seeds, lemon seeds, grape seeds, cherry, plum, prune or peach pips, or the stems of fruits.

2. Foods with small bones, other than fish or birds, should not be served even to adults. Fish and birds should be eaten with the utmost care as to the detection of bones.

3. It is careless to serve food containing fragments of nut shells, egg shells, oyster shells, crab shells and so forth and to permit containers and utensils to contribute to the food such fragments as parts of egg beaters, chips of enamel or chinaware, splinters of wood, or solder from tin cans. When a fruit jar or jelly glass breaks or chips in being opened, the contents should be strained or thrown away.

4. One should take care when cooking or serving food to see that there are no loose pins or buttons in the waist that could fall into the food.

5. Hasty eating and insufficient mastication should be avoided as dangerous.

6. Chewing of pencils, toothpicks, grass stalks, straw and the like is a cause of accidents due to foreign bodies.

7. Children should be taught not to put inedible substances smaller than a spoon in their mouths.

8. Coins are filthy things to put in the mouth and may get lodged in the throat.

9. It is careless to allow a child to run or jump with anything, even food, in his mouth.

10. Babies should not be put on the floor to amuse themselves until the floor has been cleared of all small objects, such as tacks, buttons, seeds, pins, beads, pebbles, &c.

11. Babies should not be allowed to play with corn, berries, seeds, small marbles or anything that is liable to be swallowed. Remember, it is normal for baby to put nearly everything he can get hold of into his mouth—that is part of his learning process—but he hasn't sufficient experience to reject dangerous objects. That is the parents' responsibility.

12. Nipples of nursing bottles should be too large to get into the throat.

13. Children under two years of age should never be given peanuts, peanut candy or any other kind of nut candy. They cannot chew the nuts and are liable to choke on them and inhale them into the lungs.

14. One should not set a bad example to a baby by holding a straight pin or a safety-pin in one's mouth. Remember, children are great imitators.

15. One should make a habit of closing safety-pins before laying them down, for a closed pin involves little danger.

16. Safety pins should be kept out of reach of children. (They have killed more babies than have firearms.)

17. One should not bend over a baby or take him in one's arms without making sure that there are no pins, needles, safety pins, buttons or jewellery in the waist that could get into baby's mouth or within his reach.

18. Small toys are fraught with danger to small boys—and to small girls.

19. A button box is a dangerous plaything for children; so is a string of beads.

Do not take any chances. Your child depends on you for his protection and security. Always be alert, watchful and careful—it may mean life or death to your child.

Any further information on this and other matters connected with children may be obtained by communicating personally with the Maternal and Child Welfare Information Bureau, 184 St. Paul's terrace, Brisbane, or by addressing letters, "Baby Clinic, Brisbane." These letters need not be stamped.

Koalas Must Not be Kept as Pets.

If you find a koala wandering at large, do not pick it up and take it home, but shepherd it to a place of safety, such as a suitable tree.

The koala is not an animal easy to keep as a household pet, as it requires a special diet selected from a limited number of eucalypt species, and these are often hard to obtain. Without its proper food the koala soon dies.

Koalas are totally protected in Queensland and it is an offence to harm or possess one.

ASTRONOMICAL DATA FOR QUEENSLAND.

MAY.

Supplied by W. J. Newell, Hon. Secretary of the Astronomical Society of Queensland.

TIMES OF SUNRISE AND SUNSET.

At Brisbane.			MINUTES LATER THAN BRISBANE AT OTHER PLACES.					
Day.	Rise.	Set.	Place.	Rise.	Set.	Place.	Rise.	Set.
	a.m.	p.m.						
1	6.13	5.17	Cairns	12	46	Longreach	28	42
6	6.16	5.13	Charleville ..	26	28	Quilpie	36	34
11	6.19	5.09	Cloncurry	38	61	Rockhampton ..	2	18
16	6.21	5.06	Cunnamulla ..	31	27	Roma	16	18
21	6.24	5.04	Dirranbandi ..	21	17	Townsville ..	11	38
26	6.27	5.02	Emerald	13	26	Winton	31	50
29	6.29	5.00	Hughenden ..	23	47	Warwick	5	4

TIMES OF MOONRISE AND MOONSET.

At Brisbane.

Day.	Rise.	Set.
	p.m.	p.m.
1	12.10	10.52
2	12.45	11.46
3	1.17	..
		a.m.
4	1.47	12.40
5	2.16	1.34
6	2.45	2.28
7	3.15	3.24
8	3.48	4.22
9	4.26	5.23
10	5.11	6.28
11	6.03	7.35
12	7.03	8.42
13	8.09	9.44
14	9.18	10.40
15	10.26	11.28
		p.m.
16	11.32	12.10
17	..	12.47
	a.m.	
18	12.36	1.21
19	1.37	1.53
20	2.38	2.25
21	3.39	3.00
22	4.39	3.37
23	5.41	4.18
24	6.42	5.04
25	7.40	5.55
26	8.34	6.49
27	9.22	7.45
28	10.05	8 42
29	10.43	9.37
30	11.16	10.31
31	11.46	11.24

MINUTES LATER THAN BRISBANE (SOUTHERN DISTRICTS).

Charleville 27 ; Cunnamulla 29 ; Dirranbandi 19 ;
Quilpie 35 ; Roma 17 ; Warwick 4.

MINUTES LATER THAN BRISBANE (CENTRAL DISTRICTS).

Day.	Emerald.		Longreach.		Rockhampton.		Winton.	
	Rise	Set.	Rise.	Set.	Rise.	Set.	Rise.	Set.
1	11	27	26	43	1	18	29	51
6	20	19	36	35	11	10	42	40
11	30	10	46	24	21	0	53	27
16	24	13	40	29	15	3	46	32
21	14	25	30	41	5	16	34	47
26	10	30	25	45	0	21	27	53
31	15	22	30	38	6	13	35	44

MINUTES LATER THAN BRISBANE (NORTHERN DISTRICTS).

Day.	Cairns.		Cloncurry.		Hughenden.		Townsville.	
	Rise.	Set.	Rise.	Set.	Rise.	Set.	Rise.	Set.
1	8	48	36	62	21	48	8	40
3	17	44	41	60	26	46	15	37
5	27	34	48	54	33	39	22	29
7	37	24	55	46	40	31	31	21
9	47	13	63	39	47	24	39	13
11	55	4	68	33	51	19	45	5
13	55	3	68	32	51	18	45	4
15	46	9	62	36	47	22	38	9
17	41	20	57	44	42	29	34	18
19	29	31	50	52	35	37	25	27
21	18	42	42	59	27	44	16	36
23	8	51	36	64	21	50	8	43
25	3	56	34	67	18	53	4	46
27	5	52	35	65	19	50	5	44
29	11	45	38	60	23	46	10	37
31	20	36	43	55	28	40	17	31

Phases of the Moon.—First Quarter, 2nd May, 1.58 p.m.; Full Moon, 10th May, 6.16 a.m.; Last Quarter, 17th May, 12.39 a.m.; New Moon, 24th May, 5.28 a.m.

On 15th May the sun will rise and set about 22 degrees north of true east and true west respectively, and on the 6th and 19th the moon will rise and set approximately at true east and true west respectively.

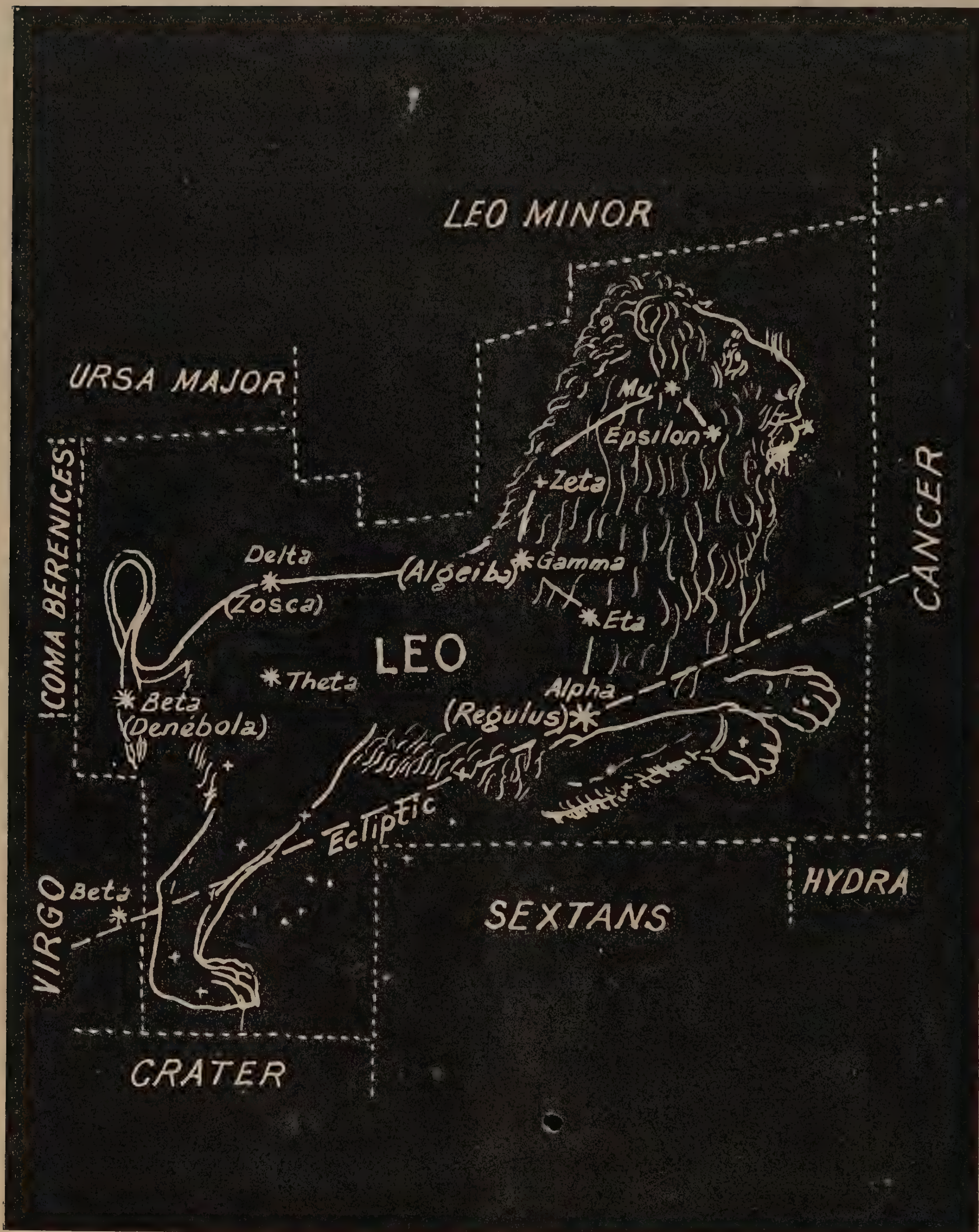
Mercury.—A morning star all this month. On the 3rd, in the constellation of Pisces, it will reach its greatest angle west of the sun and will rise over two hours before sunrise. By the end of the month it will be placed in the constellation of Taurus and will rise ¾ hour before the sun.

Venus.—Also in the constellation of Pisces at the beginning of the month, rising just over one hour before the sun. By the end of the month, in the constellation of Taurus, it will rise only 30 minutes before the sun. In the middle of May, Mercury will rise about one hour before Venus and will then be situated higher above the horizon. It is, however, much fainter than Venus. Mercury then should not be confused with Jupiter, which will be nearby.

Mars.—At the beginning of the month, in the constellation of Libra, will rise in the east at sunset. By the end of the month, in the constellation of Virgo, it will rise during the afternoon daylight hours and be well up in the eastern sky at nightfall, setting between 3.30 a.m. and 4.45 a.m.

Jupiter.—Too close in line with the sun for observation at the beginning of May, but at the end of the month, in the constellation of Aries, it will rise about two hours before sunrise. On the 6th it will be close to Venus, and it will be in the vicinity of Mercury on the 17th, Jupiter being the brighter of the two.

Saturn.—In the constellation of Virgo, well set between 4 a.m. and 5.15 a.m. at the beginning of the month and between 1.45 a.m. and 3 a.m. at the end of the month.



THE CONSTELLATIONS.

LEO (THE LION).

This is one of the zodiacal constellations and lies on the ecliptic between the zodiacal constellations of Virgo and Cancer. It was figured on ancient star maps as the fierce Nemean Lion, slain by the hero, Hercules, as the first of the twelve labours set by Eurystheus. Viewed from the northern hemisphere, an outline of the main stars of this group gives the impression of a crouching lion or sphinx. Regulus (Alpha) is a first magnitude star and was used by Hipparchus in his measurement of the precession of the equinoxes—the phenomenon which has caused the sun to appear in a different constellation, now, at the equinox, to that in which it appeared in the days of Hipparchus and earlier astronomers. In olden times, when the sun was in the constellations of Capricornus and Cancer it was at its maximum angle south and north of the celestial equator respectively. Now, however, when the sun is at these positions it is in the constellations of Sagittarius and Gemini respectively. Alpha (Regulus), Eta, Gamma (Algeiba), Zeta, Mu and Epsilon form the well-known sickle, of which Alpha and Eta form the handle and the others the curving blade. Beta (Denebola) is a second magnitude star nearest the constellation of Virgo, and Zeta is known by the name Zosca. Gamma is a double star while Epsilon has two companions and Zeta three. This constellation holds the radiant point of an important meteor shower known as the November Leonids, as they are usually most numerous between 10th and 15th November each year. This shower is said to be associated with Temple's Comet of 1866. Startling showers of so called "shooting stars" appeared to come from this constellation in 1799, 1833, and 1866, and were numbered in many hundreds per hour.

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Pulse Crops (Beans and Peas).

H. M. GROSZMANN, Horticulturist.

OF all the families of plants that have contributed species useful to man, the legumes rank second only to the grasses. As a group, they possess the valuable property of obtaining nitrogen from the air through the action of micro-organisms associated with their roots. They also provide many outstanding pasture plants, some useful cover crops for protecting and enriching the soil and several important food plants. The last group, consisting of beans and peas, are combined under the name of pulses. The edible portion of the plant may be the young green pod, the seed shelled from the green pod or the dried seed.

In English-speaking countries, beans which are eaten in the green pod (green snap or fresh bean) stage, or as dried seed, belong mainly to the genus *Phaseolus*. This genus includes French or kidney bean, Lima bean, and scarlet runner bean, as well as several species which are used for food only in Asiatic countries. Other edible beans are broad bean, snake bean (which is a close relative of the cowpea), soybean, sword bean, pigeon pea, Tonga bean and Garbanzo bean or gram.

FRENCH BEAN.

French or kidney beans (*Phaseolus vulgaris*) are important cultivated crops in Queensland and include climbing and dwarf varieties of green and blue podded beans, wax or butter beans, and also dry-shell or navy beans. The species is probably of Mexican origin and many varieties have been grown in tropical America for centuries.

The varieties most commonly grown in Queensland for the fresh bean market are dwarf green-podded string types. Brown Beauty (Plate 124) is easily the most popular, though Hawkesbury Wonder (Plate 124), Tweed Wonder, St. Andrews and Staley's Surprise are commercially important in some districts.

Climbing and stringless varieties have not become popular, though they are grown extensively in other countries. The climbing varieties bear heavy crops but the plants must be staked and this is a handicap to commercial production. The green-podded variety, Epicure, is highly esteemed for the home garden and yields well over a long period.

The stringless varieties tested in Queensland have borne light crops of usually rather short pods. Although the round pod character of many of the best stringless varieties has not so far appealed to the

Plate 124.

Pod Types in the French Bean. From top to bottom.—Brown Beauty, New Beauty, Hawkesbury Wonder, Richmond Wonder and Florida Belle.

consumer, stringlessness is a desirable quality and better flat-podded types may soon be available. Under normal air temperatures, stringless beans do not carry as well as the string varieties, but with the probable introduction of low temperature storage and transport, this defect may have little significance in the future. Some of the main dwarf stringless varieties are Bountiful, Plentiful, Streamliner, Tendergreen, Florida Belle (Plate 124), Landreth and Top Crop.

Wax podded varieties such as Startler Wax, Brittle Wax and Black Seeded Wax, which produce yellow pods of fine quality, are often grown in the home garden. Their cultural requirements are much the same as those of the green-podded varieties.

Producing Areas.

Commercial production of fresh beans has developed mainly as a winter industry in frost-free areas along the south-eastern coast from Gympie to the Queensland-New South Wales border. The chief centres of production are in the Mary Valley, the Maroochy Shire and the Redlands area. The greater part of the crop is consigned to the large southern markets of Sydney and Melbourne.

In summer, the French bean crop is grown in the cool highlands of the Granite Belt, which produce about 50,000 bushels. The total annual production for the State is over 500,000 bushels.

Climatic Requirements.

Growing conditions are usually satisfactory for beans during the autumn in the coastal areas of south-eastern Queensland. Winter temperatures, however, are rather low, but it still pays to grow winter crops in frost-free areas. Summer temperatures are, on the other hand, too high for optimum growth, and the crop does much better in the highlands of the Granite Belt at that period of the year.

French beans are susceptible to frost damage and they can be grown during winter only in frost-free localities. Even where no frost is experienced, prolonged low temperatures or cold, drying winds during winter may adversely affect the crop. Plants exposed to low temperatures at flowering may set many pods, but as the seeds fail to develop, the pods remain dwarfed and curved (Plate 125). This abnormal condition is caused by temperatures which are not sufficiently low to injure the plant but low enough to prevent normal seed development. It is most likely to occur on land just above normal frost level. On such land, therefore, the crop should be planted at such a time that it will not be flowering during July and August; this means avoiding planting in April and May.

Strong winds do much damage by breaking the stems and blowing off leaflets and flowers, while cold winds cause both scorching and death of foliage. Windbreaks which protect a crop from cold westerly or south-westerly winds are therefore beneficial. A windbreak of standing timber should not cut off too much light from the north and east. Cowcane planted throughout the crop area in two-row strips at intervals of one to two chains also makes a useful windbreak.

Where hill slopes are planted, easterly and northerly aspects are preferred for winter beans as they are warmer than other aspects and the crop matures fairly quickly. They have the advantage not only of more sunlight, but also of protection against cold winds from the west.

Plate 125.

Winter Injury to French Beans. Note the curved and stunted pods.

Water Supply.

While many bean crops are grown without supplementary irrigation, facilities for irrigation are invaluable as they remove one of the greatest hazards in bean growing—namely, the risk of dry weather at the critical flowering and setting period. A water supply capable of yielding about an acre-inch (22,622 gallons) a week for the area being cropped is ample.

Before spending money on an irrigation plant, it is well to get the water analysed so that there will be no doubt as to its suitability for irrigating the crop.

Soils and Land Preparation.

Beans thrive on a wide range of soils from sandy loams to heavy clay loams. Light sandy loams are usually low in plant foods and dry out rapidly, while heavy clay loams are hard to work and liable to

waterlogging. The most favourable soil reaction is said to be a pH of 6, which is slightly acid, but the plant thrives over a pH range of from 5.5 to 6.5. Should the pH of the soil be less than 5, an application of dolomite or lime is beneficial, but the amount required will depend on the nature of the soil and its pH. Heavy soils need more lime than light soils with the same pH and the lime requirement increases as the pH decreases.

Preparation of the land for beans should commence at least a month before planting so that any coarse plant material turned into the soil will have time to decompose. Otherwise, the soil micro-organisms which break down the trash will make considerable inroads on the fertilizer applied in the drill before the young bean plants can use it. Early land preparation also permits better weed control, for any weeds which germinate after one cultivation are destroyed by the next. If necessary, the land can be irrigated before planting to get heavy soils into a suitable condition for cultivation. The first ploughing should be deep—not less than nine inches—and shallow tillage will then bring the ground to the right tilth for planting.

Intercycle Cropping.

Between bean seasons, the land may revert to grass and weeds, or a summer cover crop such as Poona pea, maize or white panicum may be grown in coastal areas. Maize is beginning to find more favour because of its rapid growth, but the crop must be turned in before tasselling begins or the stalks will be difficult to handle. Rotary hoes and cutaway disc cultivators handle heavy cover crops satisfactorily, but a bulky crop can also be turned in with a suitably set disc plough.

Precautions against Erosion.

While hill slopes in coastal areas provide frost-free land for the winter bean crop, they are very subject to soil erosion. This problem is greatest when land is prepared for an early autumn crop before the end of the wet season, but storm rains in spring can also be troublesome.

Where a heavy cover crop is turned in, the danger of erosion is reduced, but precautions must still be taken to prevent the accumulation of water on the ploughed land. This can be achieved by means of surface drains which trap the water flowing down the slope and divert it away from the ploughed land. These drains run across the direction of flow and require a fall of about 2 feet in 100. The distance between drains is determined by the steepness of the slope and the texture of the soil. They should be kept open and must be large enough (about 12 inches deep) to cope with a heavy fall of rain.

Where a considerable area of land is available for cultivation, it is a sound practice to alternate chain-wide strips of beans across the slope with chain-wide strips of a standing cover crop. By this method, erosion over an extensive area during heavy rains is effectively prevented.

Planting Times.

Provided that there is no great risk of frost, the home gardener can grow French beans throughout the year.

Field production of the coastal crop is carried out in winter. Planting may commence in March and continue until August, but the main planting months are April, May and June. On a hilly farm the

lower slopes which are likely to be frosted should be planted early so that the crop can be harvested before there is any serious danger of frost damage. Later plantings are then made at higher, safer altitudes.

In summer, beans are produced mainly in the cool Granite Belt, where climatic conditions are more suitable for the crop at that time of the year. Here plantings are made in spring and early summer as soon as there is little risk of frost damage after the crop has germinated.

Commercial growers usually plant small areas in succession at fortnightly intervals, as each will pick heavily for only a couple of weeks or less. This practice provides an even supply of beans for the market and permits the efficient use of labour on the farm.

Planting Distances and Seeding Rates.

Bean seed (Plate 126) is planted in drills about six inches deep and 2 ft. 6 in. apart, with two or three seeds per foot of row. Row spacings as close as two feet are not uncommon, however, and wider spacings up to three feet may also be used where the crop is cultivated with horse-drawn or power implements. About a bushel of seed per acre, or three ounces per chain-row, is required where the rows are 2 ft. 6 in. apart and the seed four inches apart in the rows, but the precise amount varies with the size of the seed. The seed can be planted either by hand or with machines which plant and fertilize simultaneously. The seed is covered with about one inch of soil. In hilly country, the crop is normally planted across the slope.

Where irrigation is not available and the seed is sown by hand, it is usual to open a few drills at a time, plant the seed and cover it before the soil has dried out excessively. This practice reduces the risk of poor germination.

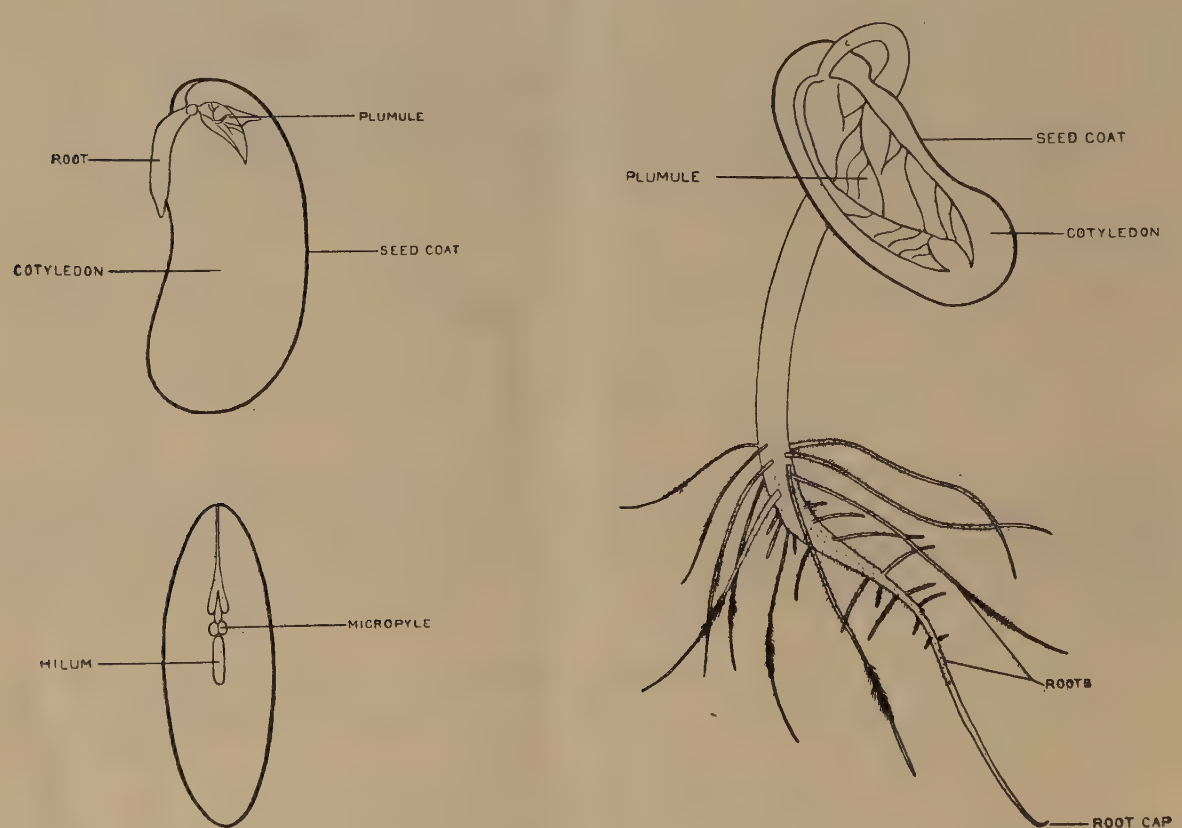

Plate 126.

Structure of the Bean Seed Before and After Germination.

Plate 127.

Bald Head. This is caused by mechanical injury to the seed and is a common source of plant failure. The growing point cannot develop and little or no growth takes place after the seed leaves appear.

Planting in deep drills (Plate 128) is a common but not a general practice. Frequently beans are planted in shallow drills and the soil is subsequently hilled up to the plants. The main purpose of hilling up is to support the plants, but planting in a deep drill and gradually filling in with a hoe as the crop develops serves the same purpose and may in fact give greater protection against wind damage.

Plate 128.

Bean Planting. Planting in deep furrows is a common practice on the North Coast, the soil being worked into the row as the beans grow.

Fertilizing Practice.

On the wide range of soils in south-eastern Queensland the winter bean crop requires a planting mixture containing nitrogen and phosphoric acid in the proportion of 1 to 3 or 4. Pronounced nodulation of the roots is rare and a nitrogenous fertilizer has always proved beneficial, perhaps because soil conditions are often far from the optimum for both the bean plant and the root nodule organism associated with it. Beneficial results have seldom been obtained from potash, but bean fertilizers generally contain about 2 per cent. of this element. The formula of the standard planting mixture is 4:15:2, and rates of application vary from 6 cwt. to 10 cwt. per acre according to the type of soil.

This mixture can best be applied in a band about six inches wide and some two inches or so below the seed. When planting by hand, a furrow is usually opened to a depth of about six inches and the fertilizer is applied in the furrow and covered with about two inches of soil by means of a scuffler hoe or fork hoe. Planting machines with a fertilizer attachment can be expected to give satisfactory results when the fertilizer is placed in a band below the seed.

The basal fertilizer dressing is sometimes applied about a week before planting, but applications just before planting are quite satisfactory and this practice lessens the possibility of nitrogen being leached from the soil by rain or of phosphates being immobilised, particularly in red-brown loams. A side dressing of sulphate of ammonia is applied at the rate of 1 cwt. per acre when the crop is a week to a fortnight old. The fertilizer is spread in a narrow band a few inches from the plant, preferably on the top side of the row when the crop is planted on sloping ground.

A fertilizer application at the rate of $\frac{1}{2}$ lb. per chain of row is equivalent to 165 lb. per acre when rows are 2 ft. apart, 132 lb. per acre when rows are 2 ft. 6 in. apart and 110 lb. per acre when rows are 3 ft. apart.

Plate 129.

A Well Cultivated Bean Crop just Before Flowering.

Cultivation.

Inter-row cultivation is designed to control weeds and to provide additional mechanical support for the beans by hilling up the soil round the base of the plants (Plate 129). The operation consists essentially in uprooting or cutting out the weeds in the inter-row space and simultaneously throwing soil into the crop row or drill, where it smothers any soft weeds between the bean plants and at the same time forms a "hill." Generally two or three cultivations are sufficient for the average crop during the growing period.

On level or nearly level land, cultivation can be carried out by horse or power drawn scufflers fitted with hilling attachments, but on sloping ground and on level ground, when the plants begin to close in, hand cultivation with hoes or hoe forks is the rule. While deep cultivation is generally harmful, shallow cultivation which merely breaks the surface crust benefits the plants considerably, particularly after cold, wet weather in winter.

Plate 130.
Irrigating the French Bean Crop with Overhead Sprays. The rows run across the slope.

Irrigation.

Irrigation is a great asset in bean production, as it facilitates land preparation and pre-planting weed control, ensures better germination of the bean seed, and reduces the risk of crop failure in dry periods which may occur at any time during the growing season and especially in the late winter months.

Overhead irrigation (Plate 130) is the general practice, the water being drawn directly from natural watercourses or from storage tanks. Generally about one acre-inch of water per week will maintain normal

plant growth in dry periods. It is particularly important that the crop should not suffer from lack of water after it begins to flower and subsequently when the pods are developing. A good watering a few days prior to the first picking helps to fill out the pods and the ground surface will still have time to dry out before picking actually begins. Frequent watering after the commencement of harvesting is undesirable, as it may increase the losses from diseases such as anthracnose, halo blight and nesting.

Plate 131.
Harvesting a Bean Crop on the North Coast.

Harvesting.

In coastal areas, the period from planting to harvesting may vary from about eight weeks in early autumn to 15 weeks on cold slopes during winter. Picking (Plate 131) commences about a month after the first flowers set and generally lasts for three weeks in each crop. If beans are picked when they are too young, they soon wilt; if they are picked when the pods begin to show swellings, the seeds continue to grow rapidly at the expense of the flesh and the pods become fibrous.

High quality beans at the correct stage of maturity can be marketed only if the crop is picked every three or four days. However, some growers handle the crops in two or three pickings in order to cut labour costs.

In average crops which yield about two tons of fresh beans per acre, or 16 lb. per chain-row, the picker can handle about a quarter of an acre per day. However, much greater yields are common and crops up to eight tons per acre have been recorded.

Packing.

Beans are usually packed for southern markets in $1\frac{1}{2}$ bushel cases, and for local markets in special bean bags (Plate 132). When packed in cases, the beans are laid across the case and a bulge of one to two inches is allowed to offset shrinkage during transit to the market. The case holds 65 to 70 lb. of beans and the special bag slightly more than 30 lb.

Plate 132.

Packing French Beans in Bags. Efficient packing at left; bad packing at right.

Just before packing begins, the case should be weighed and the tare plainly marked on the case. After packing, the beans should be kept cool both in the shed and in transit to market. The agent's name, address and number, as well as the grower's name and address, should be neatly stencilled on the ends of the case or in a prominent position on the bag.

Seed Production.

As the returns per acre from a crop grown for seed are lower than those from fresh beans, seed is produced mainly during the summer on the fertile lands around Kingaroy, 100 miles or so from the wetter coastal areas where fresh bean production is an important industry.

Some fresh bean growers save seed mainly for their own use from a spring planting which matures when the weather is dry. Occasionally, the market price for fresh beans is low when a late crop is harvested, and as there is little inducement to pick, the crop is allowed to seed.

The amount of seed produced in Queensland is well below requirements and a good deal is normally imported from the southern States. Under average storage conditions in southern Queensland, the seed remains viable for about two years, but it is generally best to plant seed from the previous season's crop, as lack of vigour has been noticed in crops grown from older seed even when germination is apparently unimpaired.

OTHER EDIBLE BEANS.

While the French bean is virtually the only bean grown on a commercial scale for the fresh bean market in Queensland, several other beans are grown on a semi-commercial scale and in the home garden. The more important of these are as follows.

Lima Bean.

Lima bean (*Phaseolus lunatus*) comes from tropical America and is adapted to tropical and sub-tropical conditions. It is not widely grown in Queensland owing to the small demand for the bean in either the green shell or dried bean form. The range of varieties includes both climbing and dwarf forms and also red-seeded and white-seeded types. The seed varies in shape and size, too, from the small-seeded Sieva types to large, flat-seeded types called Big Limas and large plump-seeded types called Potato Limas.

Some of the main varieties are Burpee's Bush, Fordhook and Henderson, all of which are dwarf types, and the climbers Early Leviathan, Giant Podded and King of the Garden. The green-podded Madagascar is really a variety of Lima bean which can be eaten in the green pod stage, while the mature dried seeds can be eaten as haricots. The crop matures in four to five months.

Scarlet Runner Bean.

Scarlet runner bean (*P. multiflorus*) prefers cool growing conditions. It is greatly relished in England, where it is preferred to the French bean. The plant is a perennial with a large storage root, and in addition to its value as a vegetable, it is a showy ornamental. In Queensland, the bean is a shy bearer.

Both white-flowered and red-flowered types are known, but the modern varieties, Streamline, Prizewinner and Scarlet Emperor, are red-flowered.

Broad Bean.

Like the scarlet runner, the broad bean (*Vicia faba*) prefers cool growing conditions. It is an erect annual two to four feet high and the seed may be eaten as a green vegetable and also in the dried form.

The crop is sown early in winter, the seed being planted two inches deep and spaced six inches apart in rows about three feet from each other. Although the plant will tolerate a wide range of soil types, it does best in well-limed heavy clay loams. In Queensland, the crop is often shy bearing in habit.

Two of the best varieties available are Early Long Pod and Cole's Dwarf Prolific.

Snake Bean.

Snake bean (*Vigna sinensis* subsp. *sesquipedalis*) is closely related to cowpea and carries long, rounded pods which are picked when half grown for use as fresh beans. The plant is particularly adapted to warm climates and is rather a popular summer vegetable in North Queensland. The plant sets well and suffers very little from pests and diseases.

Being a climber, snake bean is grown on stakes about six feet high, which are commonly placed in rows about 2 ft. 6 in. apart and braced to a light ridge pole.

Varieties are available with brown, black or variegated seeds. The brown-seeded type is probably the best, for it has an extended cropping season and bears long, fleshy pods. The variegated type is sometimes grown as a bush, and bush sports from the brown type also have been recorded.

Sword Bean and Jack Bean.

Sword bean (*Canavalia gladiata*) is a summer growing, vigorous climber with flattened pods which measure up to 15 inches long by two inches broad. The pods are picked when half-grown for use as green beans. If they are left on the vine much longer, they develop a strong internal parchment and become unpalatable. The mature seed is said to be poisonous and even the young pods may not agree with some people. Its resistance to insect pests and its long bearing season make sword bean a useful garden plant.

Jack bean (*C. ensiformis*) is a bushy plant with similar but more palatable pods.

Plate 133.

Tonga Bean. Flowering Shoot, Pods and Seeds.

Tonga Bean.

The Tonga bean (*Dolichos lablab*), a native of India, is a popular vegetable for home gardens. Numerous varieties have been described, differing in colour of flowers and seeds, the former from white to dark purple, the latter from white to almost black.

In Queensland there are two main varieties in cultivation, the Common Tonga (Plate 133) and the Purple Tonga. The former has violet or pale-purple flowers and light-green pods. The pods of the Purple Tonga are a very dark green suffused on the rather crinkled edges with purple. Both are probably equally good as a vegetable, especially the young pods which are eaten here sliced like a French bean, the margin of the pod being first cut off and discarded. The nearly ripe seeds can also be cooked, and in Malaya and the East Indies the ripe seeds, too, are eaten.

This bean is a vigorous perennial climber. In Queensland, it is often known as poor man's bean, and in other countries as lablab bean, hyacinth bean and Bonavista bean.

OTHER BEANS AND OTHER USES.

In Queensland, beans are grown primarily for use as fresh beans. In some other parts of the world, however, they are more frequently used in the mature dried state, ground into meal for cakes and porridge-like dishes. Thus pigeon pea (*Cajanus cajan*) is the basic ingredient of dahl in India and Garbanzo bean (*Cicer arietinum*), sometimes called gram or chick pea, is a staple food in India, northern Africa and Spain and a characteristic item in the diet of Latin peoples all over the world. Soybean (*Glycine max*), though not an important commercial crop here, is an old staple food in the Orient that has now become important in the United States.

In the United States of America, developments in the canning of dried and snap beans have favoured the commercial exploitation of certain varieties which are particularly suitable for processing. Quick-freezing may have similar effects as the industry expands.

The varieties grown in any country are controlled largely by the consumer demand for particular types. These demands may change, but the change usually takes a long time.

PEAS.

The common vegetable pea (*Pisum sativum*) originated in Europe and northern Asia and has been in cultivation since remote times.

The plant requires a cool climate but both flowers and the immature pods are damaged by frost. Under hot conditions, pod setting is poor, vine growth is generally depressed, and when a crop matures under high temperatures, it is very subject to disease infection. Consequently, peas should be planted at such a time that they will not be flowering during either frosty or hot weather. In Queensland, suitable conditions are found in the coastal areas in the winter, and on the highland plateau of the Granite Belt in the summer. Early autumn sowings give the best results further inland. Except for summer production in the Granite Belt, peas are rarely grown for market in Queensland, but the crop is a common vegetable in home gardens. Near the coast, bean growing is more profitable.

Varieties.

There are two main groups of peas, the smooth-seeded and the wrinkled-seeded types. A third type, the sugar or edible pod pea, can when immature be eaten in much the same way as French bean.

Within these types, numerous varieties have been produced, but comparatively few have any distinctive merit. These differ in yield, time of maturity and size and colour of the pods. For canning purposes, uniform maturity is very important, as the whole crop must be harvested at the one time. In Queensland, Green Feast is the main general purpose variety, but Yorkshire Hero is preferred in the tropics for its ability to set a crop under warm conditions. Telephone, a tall-growing variety which needs staking, is popular in the home garden. Where early maturity is important, Earlicrop, which is harvested about a fortnight before Green Feast, may be grown, although the yield per acre is much lower.

Crop Management.

Peas grow well on a wide range of soil types from sandy loams to clay loams with pH values of from 5·5 to 6·5. While the greatest yields are reported from heavy loams, it is possible to produce earlier crops on light sandy loams.

As in the case of French bean, the land should be prepared for a pea crop some weeks before planting in order to allow any vegetable matter to break down and also to provide an opportunity for controlling weeds. If the pH is much below 5·5, an application of lime before planting will be beneficial.

In field crops, seed is planted either by hand or with a planting machine in drills 18 inches to two feet apart, allowing three or four seed per foot and covering them to a depth of about an inch. The rate of seeding ranges from 1 to 1½ bushels per acre. Peas grown for canning are normally planted with grain drills and the rate of seeding is much heavier; under this system no cultivation takes place after the crop is sown.

For home gardens, the crop may be grown in rows about three feet apart, with any necessary stakes or trellises.

The standard 4:15:2 bean fertilizer has given good results with peas and a basal dressing of 4 cwt. per acre in the drill is usually adequate on all but very poor soils. The seed should not be placed in direct contact with the fertilizer or germination may be poor. The fertilizer is therefore first covered with soil to a depth of about two inches before the seed is planted.

The crop matures about 12 weeks after planting and the pods are ready to pick when they are well filled but before they begin to lose their green colour and turn yellow. Average yields are about 65 bushels per acre, but crops of over 100 bushels are not uncommon. Peas are usually marketed in bushel bags, though 2-bushel bags are sometimes used.

10

TUBERCULOSIS-FREE CATTLE HERDS.
(AS AT 21st APRIL, 1952.)

Breed.	Owner's Name and Address of Stud.
Aberdeen Angus ..	The Scottish Australian Company Ltd., Texas Station, Texas
	F. H. Hutton, "Bingegang," Dingo
A.I.S.	F. B. Sullivan, "Fermanagh," Pittsworth
	D. Sullivan, "Bantry" Stud, Rossvale, *via* Pittsworth
	W. Henschell, "Yarranvale," Yarranlea
	Con. O'Sullivan, "Navillus Stud," Greenmount
	H. V. Littleton, "Wongalea Stud," Hillview, Crow's Nest
	J. Phillips and Sons, "Sunny View," Kingaroy
	Sullivan Bros., "Valera" Stud, Pittsworth
	Reushle Bros., "Reubydale" Stud, Ravensbourne
	H. F. Marquardt, "Chelmer," Wondai
	W. G. Marquardt, "Springlands," Wondai
	A. C. and C. R. Marquardt, "Cedar Valley," Wondai
	A. H. Sokoll, "Sunny Crest," Wondai
	W. and A. G. Scott, "Welena," A.I.S. Stud, Blackbutt
	G. Sperling, "Kooravale" Stud, Kooralgin, via Cooyar
Ayrshire	L. Holmes, "Benbecula," Yarranlea
	J. N. Scott, "Auchen Eden," Camp Mountain
	"St. Christopher's and Iona" Studs, Brookfield Road, Brisbane
	E. Mathie and Son, "Ainslie" Ayrshire Stud, Maleny
Friesian	C. H. Naumann, "Yarrabine Stud," Yarraman
	J. F. Dudley, "Pasadena," Maleny
Guernsey	C. D. Holmes, "Springview," Yarraman
Jersey	W. E. O. Meier, "Kingsford Stud," Rosevale, *via* Rosewood
	J. S. McCarthy, "Glen Erin Jersey Stud," Greenmount
	J. F. Lau, "Rosallen Jersey Stud," Goombungee
	G. Harley, Hopewell, Childers
	Toowoomba Mental Hospital, Willowburn
	Farm Home for Boys, Westbrook
	F. J. Cox and Sons, "Rosel" Stud, Crawford, Kingaroy Line
	R. J. Browne, Hill 60, Yangan
	P. J. L. Bygrave, "The Craigan Farm," Aspley
	A. Verrall and Sons, "Coleburn Stud," Walloon
	R. J. Crawford, "Inverlaw Jersey Stud," Inverlaw, Kingaroy
	P. H. F. Gregory, "Carlton," Rosevale, via Rosewood
	E. A. Matthews, "Yarradale," Yarraman
	A. L. Semgreen, "Tecoma," Coolabunia
	G. & V. Beattie, "Beauvern," Antigua, Maryborough
	L. E. Meier, "Ardath" Stud, Boonah
	A. M. and L. J. Noone, "Winbirra" Stud, Mt. Esk Pocket, Esk

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Storage of Seeds.

F. B. COLEMAN (Standards Officer) and
A. C. PEEL (Technical Advisory Officer), Standards Branch.

IN Queensland, as in all tropical and sub-tropical countries, considerable losses are experienced through failure of seeds to retain their viability during varying periods of storage. This is particularly so in North Queensland, where, under normal conditions for that part of the State, with the present storage practices certain seed loses its viability in a matter of weeks. While these losses are of economic importance to the seed seller, the Department is concerned primarily with ensuring that buyers of seed obtain supplies which will comply with the standards prescribed under the Seeds Acts.

The sale of seeds which do not comply with such standards would be an offence against the Seeds Acts and would render the seller liable to prosecution. The most important point is that the grower would lose valuable time in preparing the land and suffer economic loss through the failure of the seed to germinate and provide a crop for marketing at the appropriate time.

To understand the problem one must remember that the State of Queensland lies approximately within the 11th and the 29th parallels of latitude; more than two-thirds of the State lies north of the Tropic of Capricorn (passing just south of Rockhampton). Sub-tropical conditions are experienced in the south-eastern agricultural districts and temperate conditions on the inland highland area surrounding Stanthorpe.

In an effort to obtain some information on the most suitable methods of storing seed under Queensland conditions, an experiment was commenced just prior to the outbreak of World War II. in 1939. Unfortunately, due to many of the staff of the Branch leaving for war service and the transfer of the remainder to matters associated with the war, the experiments had to be abandoned before any definite conclusions could be drawn. However, it appeared that storage in air-tight tins, under all conditions of storage, preserved the seed most favourably, and this fact could be used as a control in any future experiments.

Following on the cessation of hostilities, the experiment was resumed using tins and linen bags as in the previous experiment, but adding to the storage materials such newer packaging materials as a proprietary chlorinated rubber preparation and a waxed cellophane container. In small laboratory scale experiments, where artificial humidity was induced, these materials showed promise as media for seed storage. This could not be said of normal cellophane, which was found to have no resistance to moisture and was consequently discarded from contemplated large scale experiments.

Except where seeds were stored under refrigeration, silica gel (a moisture absorbent chemical) was used as an alternative in each case.

Storage localities selected were—Stanthorpe, with temperate conditions; Brisbane, with sub-tropical conditions; and Cairns, with tropical conditions.

Stanthorpe is situated in the Granite Belt, approximately 110 miles south-west of Brisbane, where the atmosphere is dry and cool. The elevation is 3,000 ft. above sea level and the average annual rainfall is about 30 inches. The surrounding district is well suited to the growing of deciduous fruits.

Brisbane is situated on the Brisbane River at a point approximately 20 miles from Moreton Bay and is located in the 45 inch rainfall belt. The atmosphere is normally warm and moist in summer and dry and cool in winter. The elevation above sea level is 31 ft.

Cairns is situated on the seafront itself, approximately 1,000 miles north of Brisbane, and conditions are normally hot and moist, the average annual rainfall being approximately 80 inches. The elevation above sea level is 10 ft. The surrounding district is ideally suited for the growing of sugar-cane and other lush vegetation normally found in profusion in tropical areas.

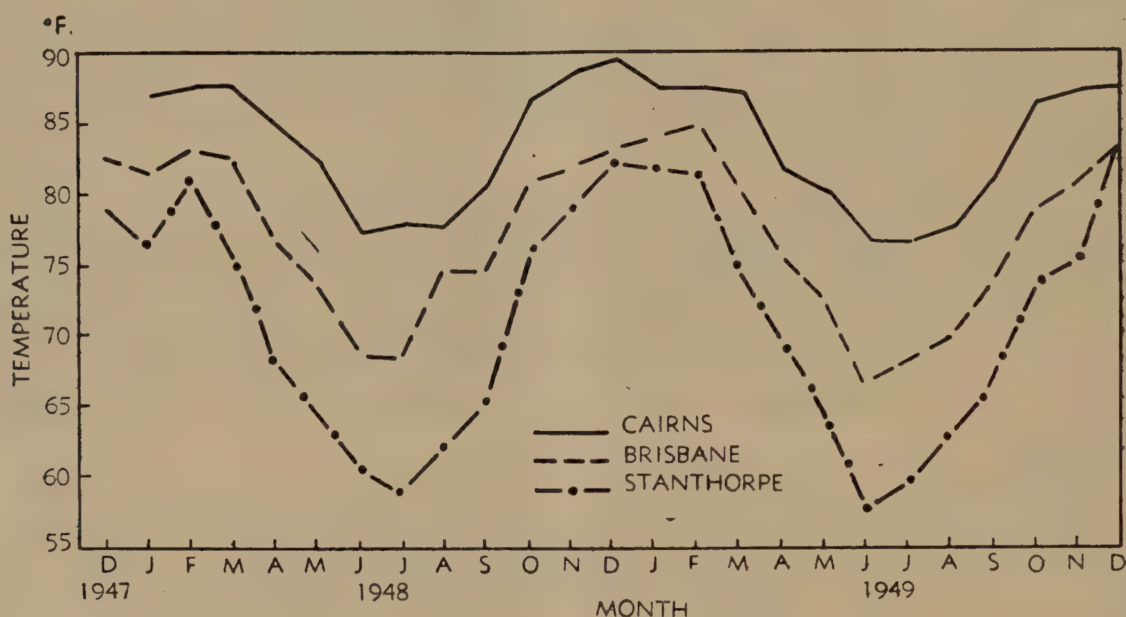


Plate 134.

Graph Showing the Average Monthly Temperature for Brisbane, Stanthorpe, and Cairns During the Progress of the Storage Tests.

Seed, like any other live organism, will deteriorate with age, even under the best storage conditions. It is suggested that the most important adverse outside influence on seed germination would be high temperature combined with high rainfall. Therefore, the accompanying graphs (Plates 134-136) have been prepared to show a comparison of temperature, rainfall and the number of days on which rain fell during the period of storage in the three localities where the seed was stored. The reader will note the parallel uniformity of maximum temperatures in the three centres, Brisbane being uniformly higher than Stanthorpe throughout the test and Cairns having approximately the same margin of temperature over Brisbane. It will also be noticed that Queensland summer rainfall could be an important factor in affecting the germination of seeds. In other words, the high rainfall occurs mainly when temperatures are highest. Furthermore, greater deterioration in germination could occur in a prolonged wet period; that is, a rainfall of seven inches spread over 13 days could be more injurious than seven inches falling in one day, as humid conditions would prevail over a longer period.

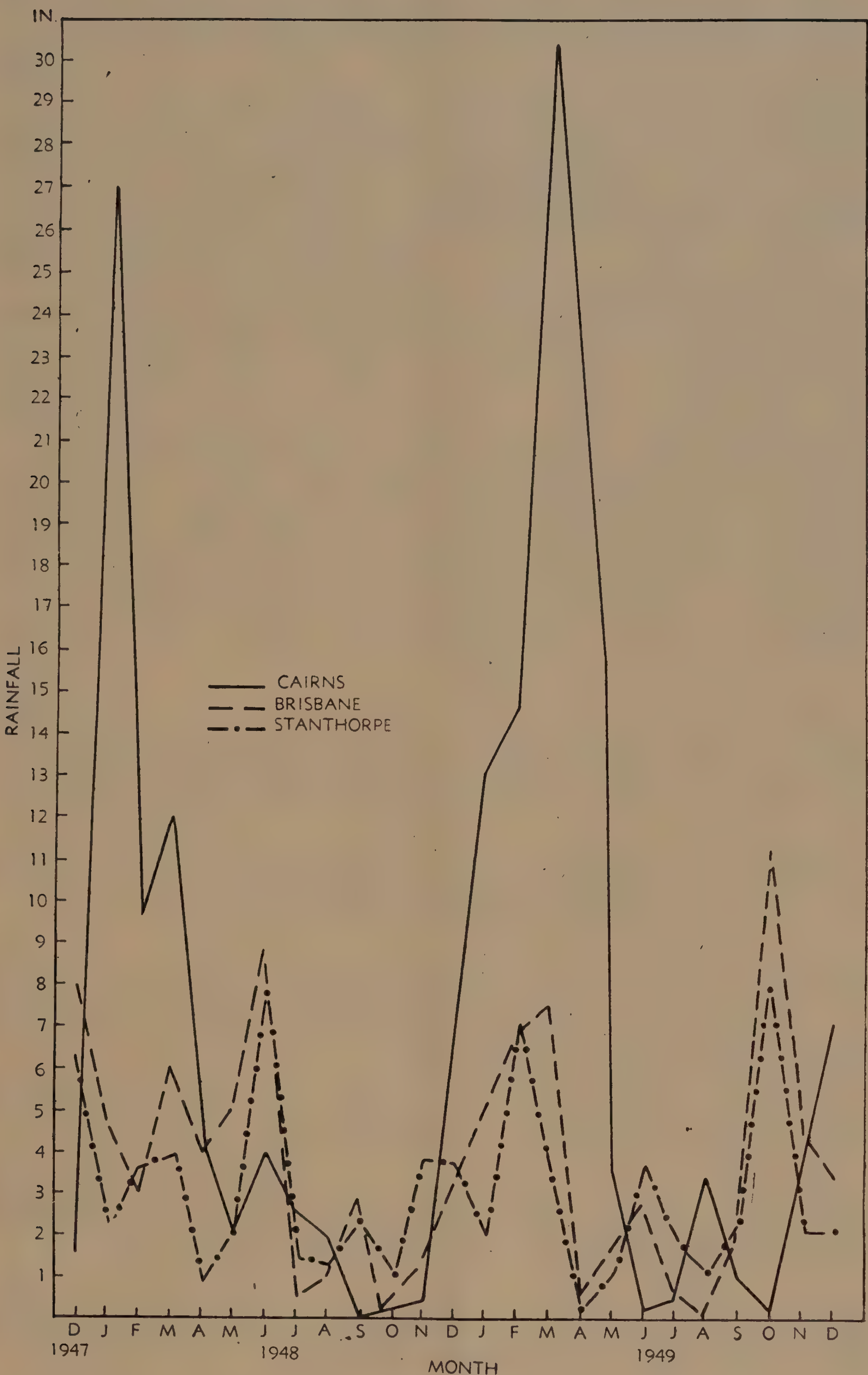


Plate 135.

Graph Showing the Monthly Rainfall for Brisbane, Stanthorpe, and Cairns During the Progress of the Storage Tests.

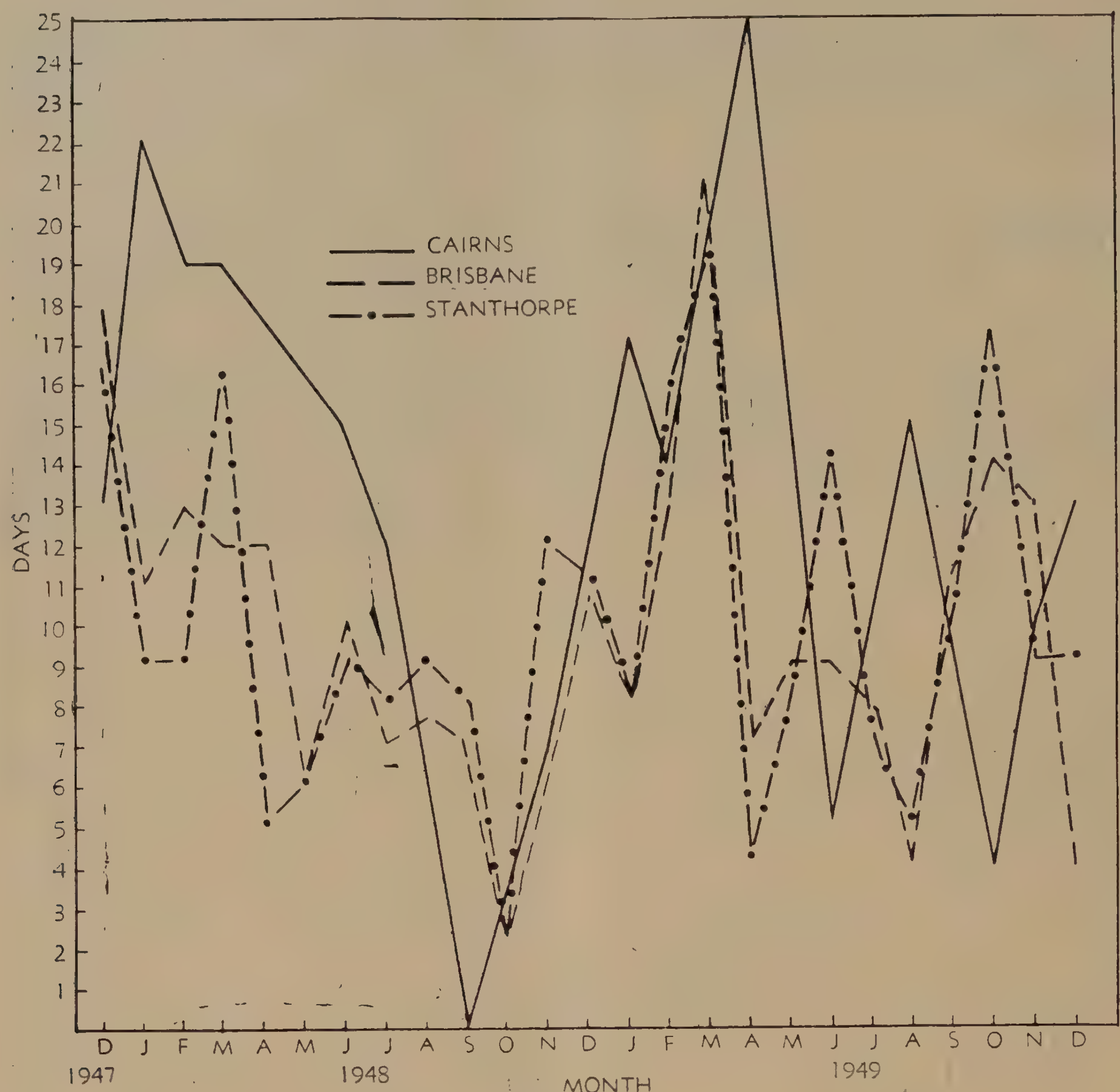


Plate 136.

Graph Showing the Number of Days on Which Rain Fell in Each Month During the Progress of the Storage Tests.

The seed used in the experiment was purchased as commercial material such as is available from any seedsman. It was not selected after testing for germination. The seeds were chosen as representing the most popular commercial varieties of the different types of vegetables mainly grown by market gardeners.

In so far as storage in tins and linen bags was concerned, the seed was first placed in paper seed packets.

Germinations were conducted at various intervals. Trays were discarded after it was reasonably sure that further germination would not take place, and in no case were they retained longer than the period specified in the International Rules for Seed Testing.

The germination results are set out in the accompanying tables according to the locality and method of storage, and the following comments are offered to interpret these results.

STANTHORPE.

The seeds in their respective containers were placed on a shelf in a brick building occupied by Departmental Officers as an office. Doors and windows were opened at least five days each week.

Cucumber.

After two years' storage, no appreciable deterioration occurred in any of the four types of packages, with or without silica gel.

Carrot.

After two years' storage in tins and bags, with or without silicia gel, the seeds still retained viability higher than the minimum of 50 per cent. prescribed under the Seeds Acts.

With the chlorinated rubber package, viability was retained for 12 months, but serious deterioration took place thereafter: silicia gel slightly arrested this deterioration.

Seed in the wax-coated packets failed to germinate up to the standard of 50 per cent. following on the six-monthly test. The addition of silica gel extended the keeping qualities of the seed in this container for 12 months.

Lettuce.

While the germination of this seed was 94 per cent. at the commencement of the experiment, after three months' storage only one container (chlorinated rubber preparation) retained the seed at a germination of 90 per cent. This soon depreciated to the level of all other packets. After nine months' storage, the seed contained in tins just managed to exceed the prescribed standard of 70 per cent., but it can be stated that lettuce seed is not amenable to storage from one season to the next under any of the conditions tried in the Stanthorpe district.

Cabbage.

This seed retained its viability at a level higher than the standard throughout the two-year period. Silica gel made no appreciable difference to the storage qualities except in the case of the waxed cellophane packets.

Beet.

After two years this seed retained its germinability equally as well in all containers with or without silica gel.

BRISBANE.

Dry Storage.

The seed containers were stored on the first floor of the brick building occupied by the Department of Agriculture and Stock. The doors and windows, having an east to south-easterly aspect, were open five days of each week.

Cucumber.

The seed retained its viability well above the prescribed minimum for the full two-year period both with and without silica gel.

Carrot.

This seed retained its germination in excess of the prescribed minimum standard for two years when stored in tins and for 12 months when stored in bags. In waxed cellophane the germination was unsatisfactory generally after three months; silica gel apparently had some slight effect during this period. Seed in the chlorinated rubber package yielded an unsatisfactory test after six months.

Lettuce.

Bag storage maintained germination of this seed above the prescribed minimum for six months. All other forms of storage were unsatisfactory before three months had elapsed.

Cabbage.

Generally the seed was retained at a satisfactory germination level in all packages for 12 months with and without silica gel.

Beet.

The seed retained its viability above the prescribed minimum for the two-year period in all types of packages with and without silica gel.

Damp Storage.

The seeds, in their respective containers, were stored on a shelf near the ceiling of the ground floor of a building in which plants and cut flowers are kept for sale and in which there is a constant supply of water. Naturally the humidity was high. Doors and windows were open for 5½ days each week.

Cucumber.

A high germination was maintained with all types of packages for 12 months. After two years of storage, germination dropped below the prescribed minimum of 75 per cent. except in the case of tins with silica gel and waxed cellophane with silica gel.

Carrot.

Storage in tins without silica gel maintained germination for 12 months; with silica gel for only six months. Storage in bags, with and without silica gel, was satisfactory for six months, but after three months germination of seed stored in the chlorinated rubber package, with and without silica gel, and in the waxed cellophane package, was not satisfactory. The seed in the waxed cellophane packet, without silica gel, did not retain its germination for three months.

Lettuce.

Germination deteriorated seriously before three months' storage, and although the germination of seed stored in bags with and without silica gel was slightly better than the prescribed minimum for three months, it can be said that lettuce seed will not store for any length of time under these conditions.

Cabbage.

Germination was maintained in tins with and without silica gel and in chlorinated rubber packages with silica gel for 12 months. This latter package without silica gel and waxed cellophane package with silica gel maintained the seeds at a satisfactory germination for nine months. Other methods of storage cannot be considered as satisfactory for commercial use.

Beet.

All types of packages maintained the germination of beet seed at a level well in excess of the minimum standard for the full two-year period.

CAIRNS.

The seeds, in their respective containers, were stored on the first floor of a two-storey brick building occupied by Departmental officers as an office. Doors and windows were open at least five days each week.

Cucumber.

In tins, waxed cellophane packages with silica gel and chlorinated rubber packages—the last more particularly with silica gel—this seed retained its germination well for a period of 12 months. Waxed cellophane packages without silica gel were satisfactory for storage over a six-months' period. Bag storage failed after three months.

Carrot.

The only satisfactory storage material for this seed was tin, in which the the seed retained its germination for at least nine months.

Lettuce.

This seed cannot be stored at Cairns in any of the types of packages experimented with. Before three months had elapsed, germination had fallen from 94 per cent. to less than half that figure in the best case. A germination of nil was recorded with some forms of storage before three months.

Cabbage.

Only in tins did this seed retain germinability for nine months. The minimum standard was maintained in other forms of storage for three months, but a marked deterioration took place within six months.

Beet.

Again storage in tins maintained germination for the full two-year period: other forms of storage were satisfactory for nine months, and in cases where silica gel was used, germination was maintained even longer—not less than 12 months.

REFRIGERATOR STORAGE.

Brisbane.

The seeds, in their respective containers, were placed in an ordinary household 5½ cubic feet refrigerator in which ice blocks were allowed to form and in which other moisture carrying materials were present. The door of the refrigerator was opened several times per day in order to remove, return or add various materials. Temperature varied from 36 deg. F. to 46 deg. F.

At the end of the two-year period, not only were all seeds showing a germination well above the prescribed minimum, but, with the exception of lettuce seed, no appreciable loss of germination occurred.

The lettuce seed retained its germinability for a period of 12 months, but at the end of two years there was a loss of only 6 per cent. to 13 per cent. despite the fact that lettuce seed has very poor keeping qualities under usual storage conditions.

Cairns.

Storage of seeds in like containers was undertaken in a commercial cold storage chamber used for storage of many different types of materials, including casks of beer, at Cairns. The store was fairly moist and at times the floor was wet with drip from the overhead coils. The room would be opened for brief periods some 16 to 20 times per day and would be opened once per day for perhaps half an hour while it was being loaded with beer casks. These came direct from the brewery cold store to the freezing works for storage on behalf of various hotels until required. The casks themselves would cause little temperature fluctuation in the room, but the opening of the door for the period of filling of the room might cause some rise in temperature. The chamber was maintained between 35 deg. F. and 40 deg. F. The humidity was very high.

The final results indicated that cucumber (except in linen bags which failed in germination during the last 12 months) and beet did not suffer thereby. Cabbage showed most signs of deterioration during the last 12 months, while the carrot seed stored in tins retained its germination. However, carrot seed under the three other conditions and lettuce seed deteriorated badly.

The results of this refrigerator storage experiment, which confirm those of a previous experiment, indicate that the use of a household refrigerator or like conditions provides suitable storage on the condition that moisture is NOT allowed to have contact with the packages of seed. This can be ensured by placing the seed in watertight containers. The seed must be dry; otherwise it will not keep.

CONCLUSION.

The experiment has revealed that the ideal storage conditions are those of dry refrigeration. Where dry refrigeration is not available, the next best is normally dry, cool storage, such as would prevail at Stanthorpe; failing this, an airy brick building in Brisbane is suitable for the storage of seed—particularly in airtight containers such as tins. The moist conditions which prevail in florists' shops or in tropical areas such as Cairns, or even in a moist refrigerator, are most unsuitable for the storage of seed.

With regard to containers, storage in airtight tins was most satisfactory under all conditions. Even though one or two failures occurred with paper packets in linen bags, they were more suitable than chlorinated rubber and waxed cellophane packets. It may be that the air, while moist in certain localities, flows more freely through the paper container and is not retained inside the package.

TABLE 1.

RESULTS OF STORAGE AT STANTHORPE.

Container.	CUCUMBER. Germination—97%* Standard Minimum—75%†					CARROT. Germination—75%* Standard Minimum—50%†					LETTUCE. Germination—94%* Standard Minimum—70%†					CABBAGE. Germination—88%* Standard Minimum—65%†					BEET. Germination—80%* Standard Minimum—55% Clusters—†				
	Months Stored.					Months Stored.					Months Stored.					Months Stored.					Months Stored.				
	3	6	9	12	24	3	6	9	12	24	3	6	9	12	24	3	6	9	12	24	3	6	9	12	24
Tins—																									
Normal	95	95	93	93	89	74	72	62	71	69	68	70	72	..	56	84	84	88	89	81	79	74	73	74	72
Silica gel	96	92	95	94	93	79	73	69	72	70	73	60	78	59	61	87	83	79	85	82	81	80	74	76	79
Chlorinated rubber—																									
Normal	95	96	94	92	88	68	68	60	63	36	47	18	..	..	1	86	84	83	80	79	74	73	68	79	72
Silica gel	96	95	94	96	91	72	73	64	70	48	91	52	78	..	5	87	86	83	80	81	80	79	78	75	74
Waxed cellophane—																									
Normal	96	94	93	93	91	52	50	34	29	18	16	2	2	..	0	84	81	79	71	65	78	77	74	75	76
Silica gel	94	94	93	96	92	76	66	50	65	34	75	..	13	..	1	86	85	73	78	81	77	75	75	80	72
Linen bags—																									
Normal	97	94	94	91	93	75	69	67	71	61	72	43	57	..	23	84	81	85	85	75	77	73	72	70	78
Silica gel	95	95	91	89	90	79	72	66	71	64	66	31	54	..	14	86	84	85	79	82	75	74	75	71	67

* Germination at commencement of experiment, 25th November, 1947.

† Minimum prescribed standard.

(NOTE.—The absence of any figures at certain stages of this table indicates that for various reasons a germination test was not conducted at that period of storage).

TABLE 2.

RESULTS OF STORAGE AT BRISBANE.

Container.	CUCUMBER. Germination—97%* Standard Minimum—75%†					CARROT. Germination—75%* Standard Minimum—50%†					LETTUCE. Germination—94%* Standard Minimum—70%†					CABBAGE. Germination—88%* Standard Minimum—65%†					BEET. Germination—80%* Standard Minimum—55% Clusters—†				
	Months Stored.					Months Stored.					Months Stored.					Months Stored.					Months Stored.				
	3	6	9	12	24	3	6	9	12	24	3	6	9	12	24	3	6	9	12	24	3	6	9	12	24
DRY STORAGE.																									
Tins—																									
Normal	95	91	89	92	89	70	65	58	66	51	42	44	49	..	6	86	77	78	76	47	77	74	75	76	73
Silica gel	96	96	92	90	89	73	68	67	66	54	50	38	46	..	9	81	77	80	82	56	77	78	74	67	75
Chlorinated rubber—																									
Normal	96	92	91	91	88	62	51	47	..	18	17	7	3	..	0	87	80	78	75	59	73	82	73	73	76
Silica gel	95	95	94	94	91	75	59	51	..	27	48	12	7	..	1	84	80	81	83	58	73	86	76	79	79
Waxed cellophane—																									
Normal	93	92	90	93	85	43	22	19	..	0	1	0	1	..	0	79	71	70	63	18	78	79	69	74	73
Silica gel	96	95	92	95	92	70	51	34	..	18	13	0	2	..	0	83	77	81	81	60	79	76	82	75	79
Linen bags—																									
Normal	95	95	92	90	89	73	66	58	..	26	79	76	59	..	3	88	76	77	74	27	77	76	76	75	76
Silica gel	95	93	92	95	81	76	72	63	64	39	79	73	67	..	5	83	77	77	80	43	74	76	79	78	75
DAMP STORAGE.																									
Tins—																									
Normal	93	92	84	84	70	74	65	62	61	28	41	44	51	..	1	86	76	75	75	38	77	83	69	68	59
Silica gel	95	94	94	94	87	71	60	49	..	45	26	31	21	..	14	84	71	82	76	54	79	77	75	73	66
Chlorinated rubber—																									
Normal	95	92	87	89	73	60	35	42	..	1	1	1	0	..	0	86	70	67	..	12	72	70	69	75	64
Silica gel	93	92	91	92	73	69	54	38	..	11	18	0	0	..	0	85	72	76	73	16	76	77	76	74	72

Waxed cellophane—																									
Normal	92	86	85	87	66	41	21	16	..	0	Nil	0	0	..	0	75	37	47	..	0	73	70	71	68	68
Silica gel	94	93	91	92	78	56	38	33	..	3	Nil	0	0	..	0	82	70	76	..	6	74	78	77	73	64
Linen bags—																									
Normal	92	88	86	84	21	71	61	48	..	4	73	52	37	..	0	81	70	62	..	1	75	72	72	70	63
Silica gel	92	91	87	86	38	72	56	47	..	5	71	51	38	..	0	81	57	59	..	1	73	77	74	74	65
Refrigerator Storage.																									
Tins—																									
Normal	98	95	92	92	96	78	75	72	74	74	93	90	94	90	88	92	84	81	86	85	75	80	75	77	76
Silica gel	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Chlorinated rubber—																									
Normal	97	97	95	96	94	77	74	72	72	77	91	93	93	93	89	88	85	82	86	82	70	77	71	74	76
Silica gel	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Waxed cellophane—																									
Normal	98	95	93	94	93	76	72	72	74	73	92	89	90	95	81	89	83	83	82	81	71	76	69	70	81
Silica gel	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Linen bags—																									
Normal	95	95	93	96	95	78	73	79	76	74	92	93	93	93	85	88	87	87	86	87	74	72	70	77	75
Silica gel	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..

* Germination at commencement of experiment, 25th November, 1947.

† Minimum prescribed standard.

(Note.—The absence of any figures at certain stages of this table indicates that for various reasons a germination test was not conducted at that period of storage).

TABLE 3.

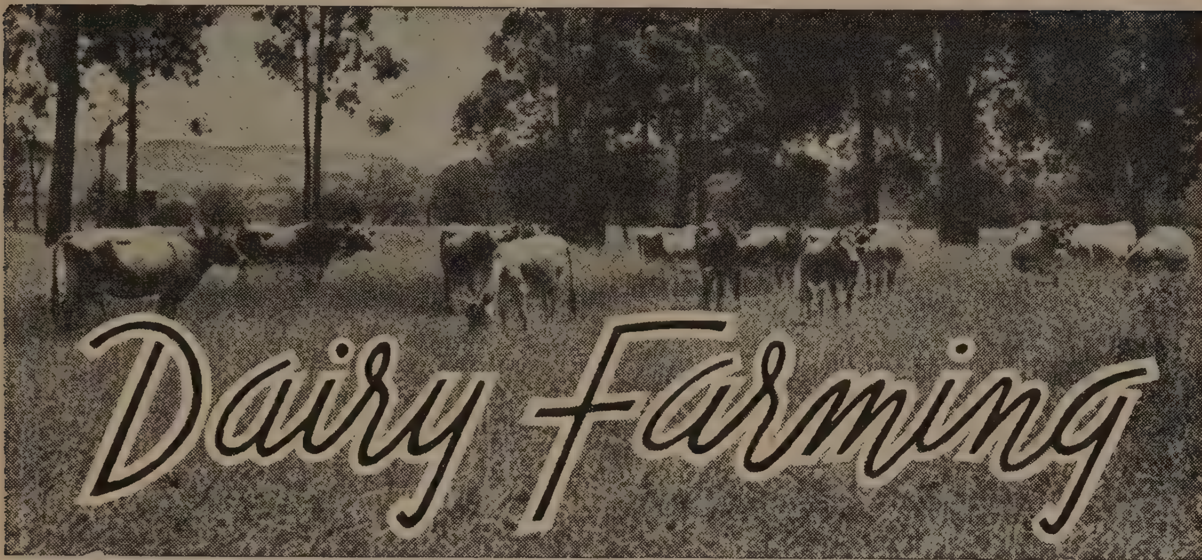
RESULTS OF STORAGE AT CAIRNS.

Container.	CUCUMBER. Germination—97%* Standard Minimum—75%†					CARROT. Germination—75%* Standard Minimum—50%†					LETTUCE. Germination—94%* Standard Minimum—70%†					CABBAGE. Germination—88%* Standard Minimum—65%†					BEET. Germination—80%* Standard Minimum—55%† Clusters.				
	Months Stored.					Months Stored.					Months Stored.					Months Stored.					Months Stored.				
	3	6	9	12	24	3	6	9	12	24	3	6	9	12	24	3	6	9	12	24	3	6	9	12	24
NORMAL STORAGE.																									
Tins—																									
Normal	94	95	91	91	62	70	67	57	..	5	41	57	43	..	0	83	77	69	..	0	77	75	73	78	60
Silica gel	93	93	90	89	68	72	66	56	..	6	41	62	44	..	0	81	79	74	58	0	72	71	74	72	65
Chlorinated rubber—																									
Normal	95	85	81	69	3	34	18	8	..	0	11	0	0	..	0	72	47	30	..	0	78	64	65	..	11
Silica gel	94	93	90	86	30	49	31	22	..	0	5	0	..	..	0	79	46	36	..	0	80	72	68	66	49
Waxed cellophane—																									
Normal	94	81	59	..	1	89	3	0	..	0	0	0	0	..	0	63	12	7	..	0	82	74	60	..	19
Silica gel	92	91	90	89	28	..	..	5	..	0	1	0	0	..	0	83	46	31	..	0	74	72	70	67	48
Linen bags—																									
Normal	88	74	67	..	0	53	33	22	..	0	35	1	0	..	0	66	37	14	..	0	71	66	59	..	20
Silica gel	89	72	67	..	0	56	30	17	..	0	30	2	0	..	0	61	33	13	..	0	71	70	67	62	14
REFRIGERATOR STORAGE.																									
Tins—																									
Normal	96	93	94	93	90	73	75	72	73	65	49	74	45	..	10	89	86	86	82	76	84	75	75	77	72
Silica gel	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Chlorinated rubber—																									
Normal	94	93	92	92	89	69	68	57	49	18	27	28	17	..	1	87	87	81	74	37	76	69	74	72	72
Silica gel	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Waxed cellophane—																									
Normal	95	92	94	93	91	46	45	33	35	7	9	2	0	..	0	81	84	79	77	7	77	77	81	71	75
Silica gel	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Linen bags—																									
Normal	94	91	87	83	65	66	69	58	47	23	2	2	7	..	1	81	84	76	63	11	77	70	69	71	68
Silica gel	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..

* Germination at commencement of experiment, 25th November, 1947.

† Minimum prescribed standard.

(NOTE.—The absence of any figures at certain stages of this table indicates that for various reasons a germination test was not conducted at that period of storage.)



The Neutralisation of Cream.

PREPARED BY OFFICERS OF THE DIVISION OF DAIRYING.

CREAM obtained from freshly-drawn milk has an acidity of about 0·12 per cent. and can be pasteurised without neutralisation. This is done in certain countries where daily deliveries are made to the factories, a notable example being Denmark.

In Denmark and some other countries, where the butter reaches the consumer in a comparatively short time, a degree of acidity is developed subsequently under carefully controlled conditions before the cream is churned.

Where cream deliveries are less frequent, bacterial activity increases the initial acidity of the cream, the actual percentage depending upon the conditions under which the cream is produced, stored, and transported.

Definition and Objects of Neutralisation.

In the strict chemical sense, neutralisation means the exact removal of all the acid present in cream to give a neutral cream. In butter factories, however, the term is used to describe the process whereby the acid in the cream is reduced to a selected acidity percentage by the addition of a calculated quantity of a suitable alkali.

The objects of neutralisation can be listed as:

(1) To permit the pasteurisation of sour cream which would otherwise curdle immediately it is heated.

(2) To improve the keeping quality of the butter. The keeping quality of butter is strongly influenced by the pH value of its serum—a value which expresses the concentration of the active portions of either acids or alkalis in a particular solution. This value is related to the percentage of acidity remaining in the cream after neutralisation and the recommendations made for the degree of neutralisation are governed by the findings of research on the influence of pH on keeping quality. This object of neutralisation is particularly important under Australian conditions, where a large proportion of the butter produced is subjected to long periods of cold storage prior to consumption.

(3) To avoid excessive loss of fat during churning due to the entrainment of fat in the particles of casein formed by coagulation when sour cream is heated.

(4) To prevent the production of undesirable flavours which can result when sour cream is subjected to high temperatures.

Choice of Acidity Standard.

The percentage of acidity to remain in the cream is decided by the factory manager on the results of his experience and on Departmental recommendations based on experiments relating pH values to keeping quality. At present, the Department recommends that pH values below 6·8 should be avoided and that very alkaline pH values (that is, above approximately 8.0) should be approached with caution. In terms of acidity percentages, this recommendation involves aiming at acidities between about 0·08 and 0·04 per cent. It is probably advantageous to aim for the lower value with first or second grade cream.

The important point in neutralisation is to select a definite standard of residual acidity for each grade of cream and to adhere as closely as possible to the standard until good cause for an alteration is shown.

Accuracy is Required.

Accurate neutralisation depends upon the following factors:—

(1) The taking of a truly representative sample for the acidity test.

(2) The performance of an accurate acidity test.

(3) An exact knowledge of the amount of cream to be neutralised.

(4) The careful weighing of the calculated quantity of the chosen neutraliser.

(5) The intimate mixing of the neutraliser with the cream before pasteurisation is attempted.

(6) The performance of regular check tests on the neutralised and pasteurised cream.

Taking an Accurate Sample.

This is the most important part of any chemical test as *an analysis can be only as accurate as the sample.* It cannot be emphasised too strongly that the sample taken must be representative of the whole of the cream awaiting neutralisation. It definitely is wrong to take the sample before all the cream has been poured into the vat, or before the contents of the vat have been mixed thoroughly. When the cream is thick in winter, it may be found necessary to preheat to enable thorough mixing prior to sampling.

Making an Accurate Acidity Test.

The conditions for accurate acidity tests were given in a previous article (*Queensland Agricultural Journal,* Feb., 1949), and for that reason no detailed discussion here is needed.

Measuring the Cream.

Inaccuracy in measuring the cream has been found to be one of the largest sources of error in neutralisation. Metal dip sticks graduated

accurately should be provided for each vat and it is important to determine the exact position in the vat for performing the measurements. Most vats have sloped bottoms to permit draining, and some have curved sides, so very different readings of the dip stick are possible in slightly varying positions in the vat.

Neutralising Components.

A large number of alkaline compounds have been used at various times for the purpose of neutralising cream. Among the more common are sodium bicarbonate, modified sodas, sodium sesquicarbonate, sodium carbonate, lime, calcium carbonate, magnesia, and magnesium carbonate. A number of these are much less suitable than others, and will not be considered.

Sodium bicarbonate ($NaHCO_3$) is a definite chemical compound, and is obtained in a high state of purity at a comparatively low cost. It does not absorb water readily from the atmosphere, and is non-caustic. Only when used in excess and subjected to prolonged high heating is there any danger of forming soaps from the fat. Its only disadvantage is the large amount of carbon dioxide liberated during neutralisation. One part of lactic acid is neutralised by 0·933 part of sodium bicarbonate.

Modified sodas are essentially mixtures of sodium bicarbonate and sodium carbonate. They may be mechanical mixtures of the two compounds in definite proportions, or definite crystalline compounds formed by crystallisation of a solution which contains both bicarbonate and carbonate. They also are known as "neutral sodas," which is a misnomer. They are somewhat caustic owing to the sodium carbonate which they contain. Because of this, care must be taken to avoid excessive over-neutralisation; otherwise soaps may be formed from the fat. They liberate less carbon dioxide than bicarbonate, and therefore cause less frothing. Each of these mixtures has its own degree of alkalinity, depending on the relative proportions of bicarbonate and carbonate, and hence is usually accompanied by special neutralising instructions or charts.

Sodium sesquicarbonate ($NaHCO_3 . Na_2CO_3 . 2H_2O$) is really one of the modified sodas, but is a definite chemical compound, which does not absorb or lose water or carbon dioxide on exposure to the atmosphere. It is found, naturally, as the mineral trona in an impure state; but it can be manufactured in a high state of purity at a reasonable cost. The amount of carbon dioxide evolved is only two-thirds of that evolved by sodium bicarbonate. One part of lactic acid is neutralised by 0·837 part of sodium sesquicarbonate, nine parts being equivalent to 10 parts of sodium bicarbonate.

Sodium carbonate is obtainable in a number of different forms. Soda ash (Na_2CO_3) is anhydrous sodium carbonate, which readily absorbs both water and carbon dioxide from the atmosphere. Crystal soda or crystal carbonate ($Na_2CO_3 . H_2O$) is a monohydrate of sodium carbonate, which is more stable than soda ash, but which, nevertheless, absorbs both water and carbon dioxide. *Sal soda or washing soda* ($Na_2CO_3 . 10H_2O$) is the decahydrate of sodium carbonate; it loses water but absorbs carbon dioxide on exposure. It usually is less pure than the other two forms. Sodium carbonate is distinctly caustic and is not generally used as a neutraliser.

Lime is used to some extent, particularly for highly acid cream. It is used generally as milk of lime (calcium hydrate), and does not cause frothing. The use of lime is much more difficult than with the soda compounds, as the strength and quality of lime varies widely, and each batch of milk of lime made up must therefore be tested to determine its neutralising power and must be kept perfectly mixed until it is required no longer. As it is seldom, if ever, used in Queensland it need not be further discussed here.

Calculating the Weight of Neutraliser Required.

A neutralising chart for the use of sodium bicarbonate, giving the weight of bicarbonate required to neutralise from 1,000 to 5,000 lb. of cream by 0·02 to 0·84 per cent. of acidity, has been published by the Department of Agriculture and Stock and is available for distribution to butter factories. A condensed version of this chart is included here. Commercial firms, particularly those selling modified sodas, also issue neutralisation charts for the neutralisers which they sell.

As the charts are liable to become damaged or destroyed it is essential that the operative performing the neutralising should be able to calculate the weight of neutraliser required.

This depends entirely upon the weight of lactic acid which is to be neutralised. This can only be obtained from an accurate knowledge of the amount of cream and the acidity percentage. It is best explainable in stages—

(*a*) Calculate the percentage of acidity reduction required by subtracting the desired acidity from the actual acidity percentage.

(*b*) Calculate the weight of lactic acid to be neutralised by multiplying the weight of cream by the percentage of acidity reduction required and dividing by 100.

(*c*) Calculate the weight of neutraliser required by multiplying the weight of lactic acid to be neutralised by the parts of the neutraliser required to neutralise one part of lactic acid.

Example—

3,000 lb. of cream containing 0·40 per cent. acidity are required to be neutralised by sodium bicarbonate to 0·08 per cent. (1 part of lactic acid is neutralised by 0·933 part of sodium bicarbonate).

(*a*) Percentage of acidity reduction required = 0·40–0·08 = 0·32 per cent.

(*b*) Weight of lactic acid to be neutralised = $\frac{3{,}000 \times 0{\cdot}32}{100}$ = 9·6 lb.

(*c*) Weight of bicarbonate required = 9·6 x 9·933 = 8·96 lb. or 8 lb. 15½ oz.

If sodium sesquicarbonate is to be used for neutralisation the calculation would be the same for the first two steps, but the third step would be as follows:—(1 part of lactic acid is neutralised by 0·837 part of sodium sesquicarbonate).

(*c*) Weight of sesquicarbonate = 9·6 x 0·837 = 8·04 lb. or 8 lb. 0½ oz.

In practice there is no necessity to work out each stage as shown above. The last two stages are combined into one equation.

$$\text{Weight of neutraliser required in lb.} = \frac{\text{Acidity reduction required} \times \text{Weight of cream in lb.} \times \text{Parts of neutraliser required to neutralise 1 part of lactic acid}}{100}$$

Applied to the above figures the equation becomes:

$$\text{Weight of sodium bicarbonate required} = \frac{0{\cdot}32 \times 3{,}000 \times 0{\cdot}933}{100} = 8{\cdot}96 \text{ lb.}$$

or—

$$\text{Weight of sodium sesquicarbonate required} = \frac{0{\cdot}32 \times 3{,}000 \times 0{\cdot}837}{100} = 8{\cdot}04 \text{ lb.}$$

The quantity of neutraliser having been calculated, it should be weighed out as accurately as possible.

Practical experience has shown, however, that when acidity values lower than about 0·06 per cent. are aimed for, it may be necessary to add more neutraliser than the theoretical quantity calculated from the chart. This additional quantity can only be determined by taking accurate check acidity tests on the cream after pasteurisation and increasing the dosage until the desired acidity reduction is obtained.

Mixing the Neutraliser with the Cream.

Having weighed out the required amount of neutraliser, it should be dissolved completely in water, as in this way it is more quickly and evenly distributed throughout the cream. The use of hot water to dissolve the neutraliser is not desirable as the bicarbonate decomposes at temperatures above 120°F. The quantity of water usually recommended is 2 gallons for each pound of neutraliser, but if the facilities for spraying the neutraliser into the cream and mixing the cream meanwhile are very efficient, it is desirable to reduce the amount of dilution by using only one gallon per pound.

There are various ways in which the solution of neutraliser may be added, ranging from manual to modern mechanical methods. It should not be mixed in a cream can and dumped bodily into the cream, as this over-neutralises the cream where the neutraliser is added. A watering can is sometimes used for this operation, but more modern methods consist of spraying the solution into the cream by means of a steam injector, by allowing it to flow from a vessel some height above the vat or by pumping.

A suitable layout of cream neutralising equipment is illustrated in Plate 137. The weighed quantity of neutraliser is added to the vat on the left and the required quantity of water added to dissolve the neutraliser. The solution is then sprayed on to the cream in the vat being used, the cream being agitated meanwhile by the stirrers whose shafts are seen at the end of each vat.

A modification of this layout which has been found satisfactory involves the holding of a standard strength neutraliser solution in a fairly large overhead tank from which the required volume of solution for each vat is run into a smaller, graduated vat prior to spraying into the cream.

CREAM NEUTRALISATION CHART.

FOR SODIUM BICARBONATE ONLY.

CALCULATED ON THE BASIS OF 1 POUND OF LACTIC ACID BEING NEUTRALISED BY 14·9328 OZ. (0·9333 POUND) OF SODIUM BICARBONATE. THE WEIGHT OF BICARBONATE FOR THE REQUIRED REDUCTION OF ACIDITY IS SHOWN TO THE NEAREST HALF-OUNCE.

Weight of Cream.	Required Reduction of Acidity (Per Cent.)														
	·02.	·04.	·06.	·08.	·10.	·14.	·18.	·22.	·26.	·30.	·34.	·38.	·42.	·46.	·50.
Lb.	lb. oz.	lb. oz.	lb. oz.	lb. oz.	lb. oz.	lb. oz.	lb. oz.	lb. oz.	lb. oz.	lb. oz.	lb. oz.	lb. oz.	lb. oz.	lb. oz.	lb. oz.
1,000	0 3	0 6	0 9	0 12	0 15	1 5	1 11	2 1	2 7	2 13	3 3	3 8½	3 14½	4 4½	4 10½
1,100	0 3½	0 6½	0 10	0 13	1 0½	1 7	1 13½	2 4	2 10½	3 1½	3 8	3 14½	4 5	4 11½	5 2
1,200	0 3½	0 7	0 11	0 14½	1 2	1 9	2 0½	2 7½	2 14½	3 6	3 13	4 4	4 11½	5 2½	5 9½
1,300	0 4	0 8	0 11½	0 15½	1 3½	1 11	2 3	2 10½	3 2½	3 10	4 2	4 10	5 1½	5 9½	6 1
1,400	0 4	0 8½	0 12½	1 0½	1 5	1 13½	2 5½	2 14	3 6½	3 14½	4 7	4 15½	5 8	6 0	6 8½
1,500	0 4½	0 9	0 13½	1 2	1 6½	1 15½	2 8½	3 1½	3 10	4 3	4 12	5 5	5 14	6 7	7 0
1,600	0 5	0 9½	0 14½	1 3	1 8	2 1½	2 11	3 4½	3 14	4 7½	5 1	5 11	6 4½	6 14	7 7½
1,700	0 5	0 10	0 15	1 4½	1 9½	2 3½	2 13½	3 8	4 2	4 12	5 6½	6 0½	6 10½	7 5	7 15
1,800	0 5½	0 11	1 0	1 5½	1 11	2 5½	3 0½	3 11	4 6	5 0½	5 11½	6 6	7 1	7 11½	8 6½
1,900	0 5½	0 11½	1 1	1 6½	1 12½	2 7½	3 3	3 14½	4 10	5 5	6 0½	6 12	7 7	8 2½	8 14
2,000	0 6	0 12	1 2	1 8	1 14	2 10	3 6	4 1½	4 13½	5 9½	6 5½	7 1½	7 13½	8 9½	9 5½
2,100	0 6½	0 12½	1 3	1 9	1 15½	2 12	3 8½	4 5	5 1½	5 14	6 10½	7 7	8 3½	9 0½	9 13
2,200	0 6½	0 13	1 3½	1 10½	2 1	2 14	3 11	4 8½	5 5½	6 2½	6 15½	7 13	8 10	9 7	10 4½
2,300	0 7	0 13½	1 4½	1 11½	2 2½	3 0	3 14	4 11½	5 9½	6 7	7 5	8 2½	9 0½	9 14	10 11½
2,400	0 7	0 14½	1 5½	1 12½	2 4	3 2	4 0½	4 15	5 13	6 11½	7 10	8 8	9 6½	10 5	11 3
2,500	0 7½	0 15	1 6½	1 14	2 5½	3 4½	4 3	5 2	6 1	7 0	7 15	8 14	9 13	10 11½	11 10½
3,000	0 9	1 2	1 11	2 4	2 13	3 14½	5 0½	6 2½	7 4½	8 6½	9 8½	10 10	11 12	12 14	14 0
3,500	0 10½	1 5	1 15½	2 10	3 4½	4 9	5 14	7 3	8 8	9 13	11 1½	12 6½	13 11½	15 0½	16 5½
4,000	0 12	1 8	2 4	3 0	3 11½	5 3½	6 11½	8 3½	9 11½	11 3	12 11	14 3	15 11	17 3	18 10½
4,500	0 13½	1 11	2 8½	3 6	4 3	5 14	7 9	9 4	10 14½	12 9½	14 4½	15 15½	17 10	19 5	21 0
5,000	0 15	1 14	2 13	3 11½	4 10½	6 8½	8 6½	10 4½	12 2	14 0	15 14	17 11½	19 9½	21 7½	23 5½

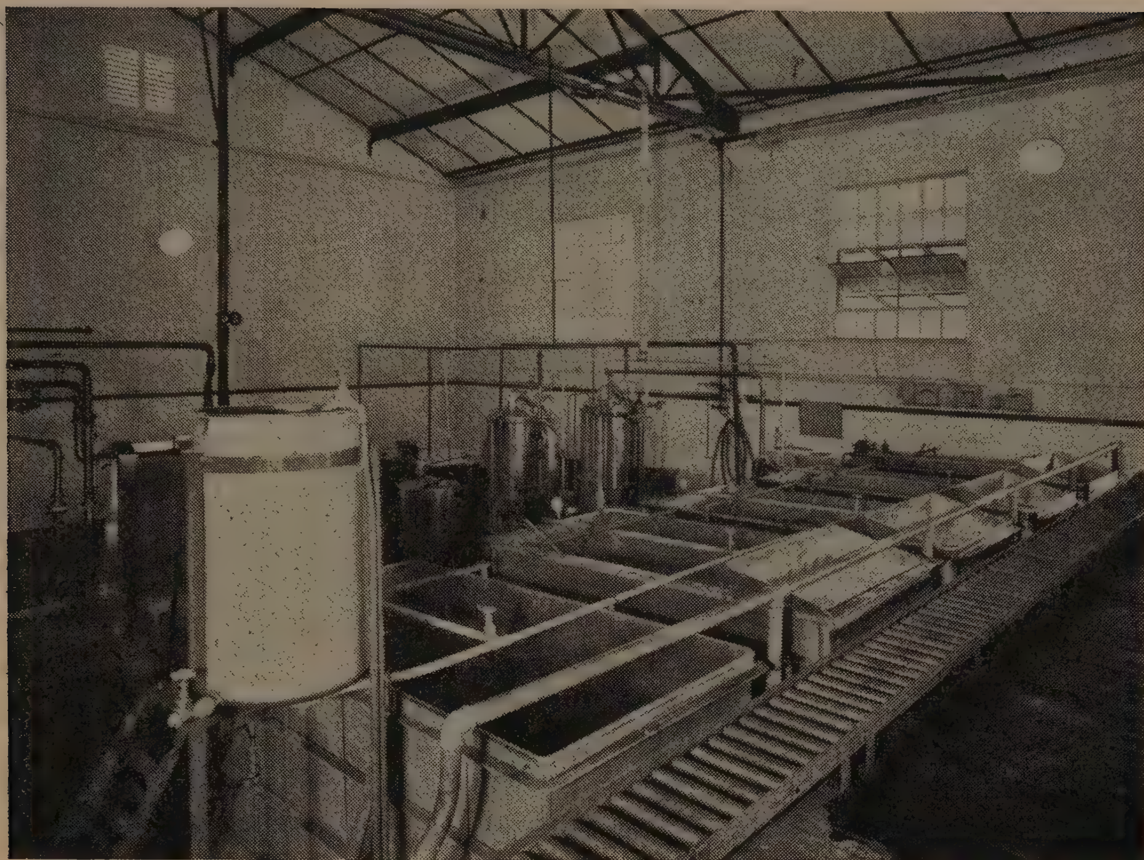


Plate 137.

A Suitable Layout of Equipment for the Neutralisation of Cream.

Some factories use a machine which adds a standard strength neutraliser solution at a predetermined rate to the cream as it flows to the pasteuriser. This machine depends for its successful use on the flow of cream being constant throughout the whole pasteurising process. This is not easy of attainment with some pasteurisers, as, after use for some time, the deposit on the pasteuriser interferes with the flow of cream, and uneven neutralisation may result. If this machine is being used, frequent acidity tests on the cream from the coolers should be made to see that the neutralisation is being done accurately.

The cream should be kept constantly agitated during the addition of neutraliser, and for some time before pasteurisation is attempted, 20 minutes being a satisfactory period. Unless this time is allowed, the acidity of the cream will not have been reduced sufficiently for efficient pasteurisation. The period of 20 minutes should not be greatly exceeded; otherwise those organisms responsible for acid production, which were held in check by the high acidity of their cream medium, may reactivate and commence acid production once more. This will be particularly so during the warmer months.

Standardisation of Cream.

In the past, dilution of the cream to standardise the fat percentage was often recommended and usually performed during the addition of neutraliser. However, the modern pasteurising equipment used at present in most factories heats the cream by direct injection of steam and condensation of steam dilutes the cream. A rough guide to the amount of dilution is to be found in the difference in temperature of the cream in the neutralising vat and as it leaves the final section of

the pasteuriser, a 10° F. difference being roughly equal to 1 per cent. dilution. Thus, if the cream entering the cooler is at 120° F., corresponding to a vacuum of about 27 inches, and the cream in the neutralising vat is at 70° F., the difference is 50° F. and the dilution about 5 per cent. This dilution, together with the 2–8 per cent. dilution during neutralisation, will reduce the fat test by 3 to 5 per cent. Further dilution than this is considered undesirable, as the modern tendency is to aim for a 35 to 40 per cent. fat test in the cream at churning to economise on refrigeration, vat space and churn space and, particularly, to minimise fat losses during churning.

Performing Check Tests for Acidity.

This is a part of factory routine which frequently is omitted. Check tests on the cream from the coolers are of great value, because they give the operator immediate information on the accuracy of neutralisation. Such check tests also serve the purpose of maintaining the keenness of the operator responsible for neutralisation.

It is also desirable to perform daily acidity tests on each vat of pasteurised cream and record the results for comparison later with pH results issued under the Butter Improvement Service. Occasions have arisen where such factors as the use of hard water for dissolving the neutraliser, and errors in the calibration of vats or bulk neutraliser tanks, caused persistent large errors which were detected by a comparison of the acidity tests and pH results.

Accurate neutralisation to a recommended degree of acidity has an important bearing on butter quality and should be the aim of every factory manager and operative.

Weights and Measures.

Under the Weights and Measures Act of 1951, all grain, agricultural and vegetable seeds, mill by-products of grain, hay, straw, chaff, and concentrated or prepared stock foods must be sold by weight and not by measure.

The Act specifies the following weights per bushel:—

Barley	50 lb.	Oats	40 lb.
Beans	60 lb.	Peas	60 lb.
Bran	20 lb.	Pollard	20 lb.
Cowpeas	60 lb.	Rye	60 lb.
Grain Sorghum ..	60 lb.	Wheat	60 lb.
Maize	56 lb.		

The ton weight for bran, pollard and flour is 2,000 lb. and for other articles 2,240 lb.

A superficial foot of timber contains 144 cubic inches.

A gallon of water weighs 10 pounds.

A Milk Vat Stand for the Dairy.

J. D. ELRINGTON, Dairy Adviser (Machinery), Division of Dairying.

A SUITABLE type of vat stand for dairy farms is shown in Plate 138. It consists of a length of 2-inch pipe concreted in the ground and carrying a welded frame fitted over its top, which is able to revolve. A washer is placed between the two parts to take the wear.

The stand can be used for either a round or a square vat.

This type of stand has two advantages:—

(1) It is hygienic, having only one leg on the floor, and is second only in this respect to the completely suspended stand.

(2) It can be revolved so that the vat tap is moved away from the separator. This permits the milking machine wash-water to be run into a bucket. There is no need to move the vat on the stand, as is necessary with ordinary types of vat stands.

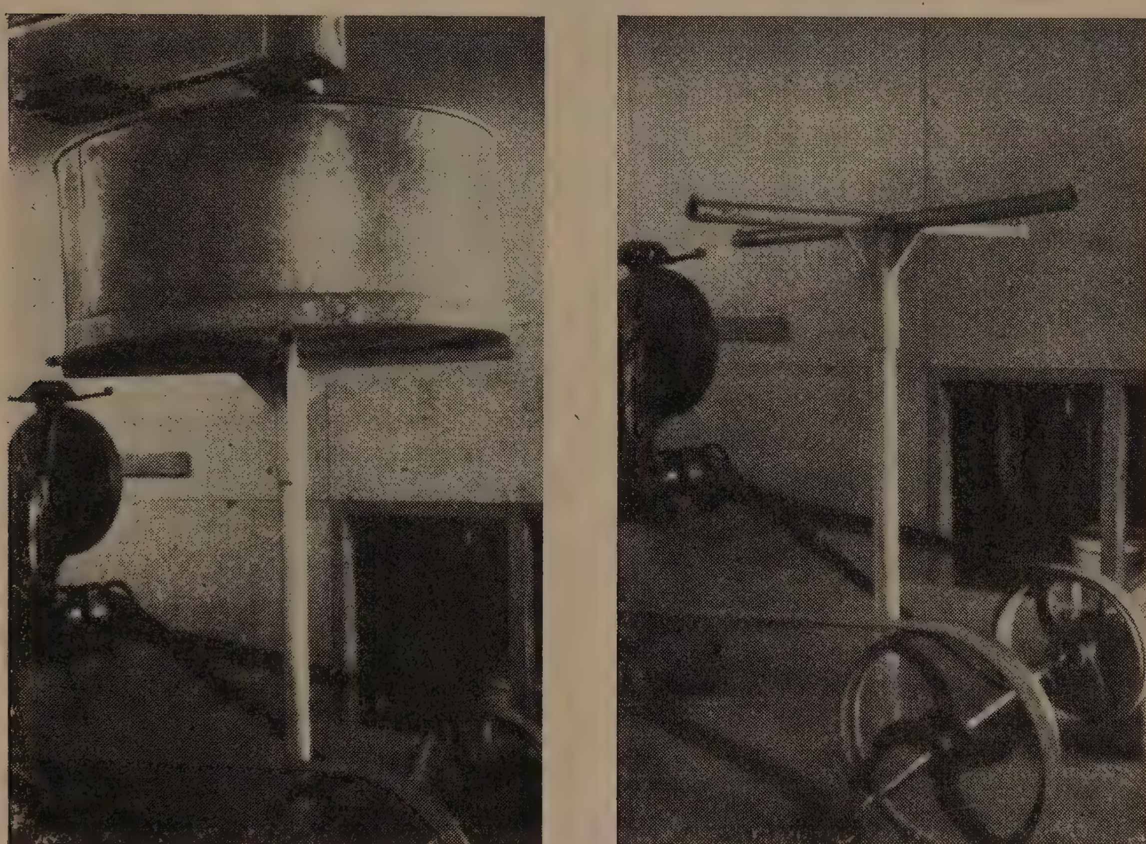


Plate 138.
Milk Vat Stand With and Without Vat.

CHANGE OF ADDRESS.

Journal subscribers notifying change of address should state their full Christian names and surname as well as their full former and new addresses.

Address all communications to the Under Secretary, Department of Agriculture and Stock, Brisbane.

Brucellosis Testing of Swine.

The Department of Agriculture and Stock is operating a scheme whereby pig herds are tested at intervals for the occurrence of swine brucellosis (contagious abortion).

A herd listed by the Department as ''brucellosis tested'' is one in which all such animals as may be determined by the Director of the Department's Division of Animal Industry have been subjected to two successive tests for brucellosis, at intervals determined by him, without any positive reactors being found.

In order for a herd to be retained on the list of Tested Herds, a semi-annual or annual re-test of the herd, as determined by the Director, is required. If at a re-test any animal gives a positive reaction to the test the herd is removed from the list; it is not listed again until subsequent tests, as determined by the Director, have been carried out.

Full particulars of the Brucellosis Testing of Swine and application forms may be obtained from the Under Secretary, Department of Agriculture and Stock, William Street, Brisbane.

TESTED HERDS.
(AS AT 21st APRIL, 1952.)

Breed.	Owner's Name and Address of Stud.
Berkshire	S. S. Ashton, " Scotia " Stud, Pittsworth
	J. J. Bailey, " Lucydale " Stud, East Greenmount
	S. Cochrane, " Stanroy " Stud, Felton
	Garrawin Stud Farm Pty. Ltd., 657 Sandgate road, Clayfield
	G. Handley, " Handleigh " Stud, Murphy's Creek
	J. L. Handley, " Meadow Vale " Stud, Lockyer
	R. G. Koplick, " Melan Terez " Stud, Rochedale
	H. V. Littleton, " Wongalea " Stud, Crow's Nest
	O'Brien and Hickey, "Kildurham" Stud, Jandowae East
	E. Pukallus, " Plainby " Stud, Crow's Nest
	G. C. Traves, " Wynwood " Stud, Oakey
	E. Tumbridge, "Bidwell " Stud, Oakey
	Westbrook Farm Home for Boys, Westbrook
	H. W. Wyatte, Rocky Creek, Yarraman
	H. M. State Farm, " Palen Creek," Palen Creek
	A. R. Ludwig and Sons, " Cryna " Stud, Beaudesert
	H. H. Sellars, " Tabooba " Stud, Beaudesert
	F. Thomas, " Rosevale " Stud, Beaudesert
	Bowkett and Meacle, " Myola Vale " Stud Piggery, Burra Burri, Jandowae
	D. T. Law, Trouts Road, Aspley
	R. J. McCullough," Maxholm " Berkshire Stud, Gatton
	C. F. W. and B. A. Schellback, " Redvilla " Stud, Kingaroy
	R. H. Crawley, " Rockthorpe " Stud, *via* Pittsworth
	F. R. J. Cook, " Alstonvilla," Wolvi, via Gympie
	D. E. and E. C. Apelt, "Thelmur," Oakey
	Mrs. I. M. James, "Kenmore" Stud, Cambooya
	H. L. Stark, "Florida," Kalbar
Large White	H. J. Franke and Sons, " Delvue " Stud, Cawdor
	Garrawin Stud Farm Pty. Ltd., 657 Sandgate road, Clayfield
	F. L. Hayward, " Curyo," Jandowae
	J. A. Heading, " Highfields," Murgon
	K. B. Jones, " Cefn " Stud, Pilton
	R. G. Koplick, "Melan Terez " Stud, Rochedale
	R. Postle, " Yaralla " Stud. Pittsworth
	E. C. Smith, "Smithfield" Stud, Coomera
	E. J. Bell, " Dorne " Stud, Chinchilla
	A. G, Fry, "Birubi" Stud, Dalby
	N. E. Myers, Halpine Plantation, Kallangur

TESTED HERDS—continued.

Breed.	Owner's Name and Address of Stud.
Large White—*continued*	L. C. Lobegeiger, "Bremer Valley" Stud, Moorang, *via* Rosewood
	J. H. G. Blakeney, "Talgai" Stud, Clifton
	V. P. McGoldrick, "Fairymeadow" Stud, Cooroy
	N. Woltmann and Sons, Wooroolin
	R. S. Powell, Kybong, via Gympie
	E. B. Horne, "Kalringal," Wooroolin
	S. T. Fowler, "Kenstan" Stud, Pittsworth
	J. A. and J. McNicol, "Camden," Canning Vale, Warwick
Tamworth	S. Kanowski, "Miecho" Stud, Pinelands
	N. R. Potter, "Actonvale" Stud, Wellcamp
	D. F. L. Skerman, "Waverley" Stud, Kaimkillenbun
	A. C. Fletcher, "Myola" Stud, Jimbour
	L. C. Lobegeiger, "Bremer Valley" Stud, Moorang, *via* Rosewood
	Salvation Army Home for Boys, Riverview
	F. Thomas, "Rosevale" Stud, Beaudesert
	A. J. Surman, Noble Road, Goodna
	P. V. McKewin, "Wattleglen" Stud, Goombungee
	Department of Agriculture and Stock, Regional Experiment Station, Kairi
	P. V. Campbell, Lawn Hill, Lamington
	E. C. Phillips, "Sunny View," M.S. 90, Kingaroy
	T. A. Stephen, "Withcott," Helidon
Wessex Saddleback ..	W. S. Douglas, "Greylight" Stud, Goombungee
	K. Day and P. Hunting, "Kazan" Stud, Goodna
	E. Sirrett, "Iona Vale" Stud, Kuraby
	C. R. Smith, "Belton Park" Stud, Nara
	H. H. Sellars, "Tabooba" Stud, Beaudesert
	H. Thomas, "Eurara" Stud, Beaudesert
	D. T. Law, Trouts Road, Aspley
	G. J. Wilson, "Glenbella" Stud, Silverleigh
	G. J. Cooper, "Cedar Glen," Yarraman
	J. B. Dunlop, Acacia Rd., Kuraby

HAVE YOUR SEEDS TESTED FREE

The Department of Agriculture and Stock examines FREE OF CHARGE samples representing seed purchased by farmers for their own sowing.

The sample submitted should be representative of the bulk and a covering letter should be sent advising despatch of the sample.

MARK YOUR SAMPLE

Sample of .... seed
Drawn from .... bags
Representing a total of ....
Purchased from ....
Name and Address of Sender
Date.......................

SIZE OF SAMPLE

Barley -	8 oz.	Oats -	8 oz.
Beans -	8 oz.	Peas -	8 oz.
Grasses	2 oz.	Sorghum	4 oz.
Lucerne	4 oz.	Sudan -	4 oz.
Millets	4 oz.	Wheat -	8 oz.
Vegetable Seeds - ½ oz.			

SEND YOUR SAMPLE TO—**STANDARDS OFFICER, DEPARTMENT OF AGRICULTURE AND STOCK, BRISBANE.**

Vital Statistics and the Queensland Sheep Industry.—Part 2.

G. R. MOULE, Director of Sheep Husbandry.

THE use of vital statistics in relation to the sheep industry has been discussed in a previous article. The purpose of this article is to outline the position of the industry as indicated by the figures already compiled by the various organisations which collect statistics designed to measure its welfare.

HOW FIGURES ARE COLLECTED IN QUEENSLAND.

The principal figures collected in Queensland are those contained in the statistical returns submitted by woolgrowers during the early part of each year. It is fully realised that these may not always be as exact as producers would like them to be, but because a large number of returns are received any errors tend to cancel one another. Figures of the type collected in the returns are most useful in indicating trends, rather than for making detailed studies of the welfare of individual flocks in particular districts.

The trends which are indicated by the available figures pertaining to the Queensland sheep industry are discussed in the following sections.

THE SHEEP POPULATION.

Since 1890 sheep numbers have fluctuated about an average of 18.5 million. By far the greatest proportion of the sheep is of the Merino breed and only 2-3 per cent. of the total is comprised of Corriedales, British breeds and their crosses.

Figure 1 shows the sheep population in Queensland for all years between 1890 and 1950. It is seen that the State's flock decreased during the 1902 drought to reach the lowest total of about 7 millions. It increased to 26 millions in 1942.

While seasonal conditions have had an important bearing on sheep populations, their influence has operated in different ways. For instance, the majority of the losses in the 1900-1902 drought were reported to

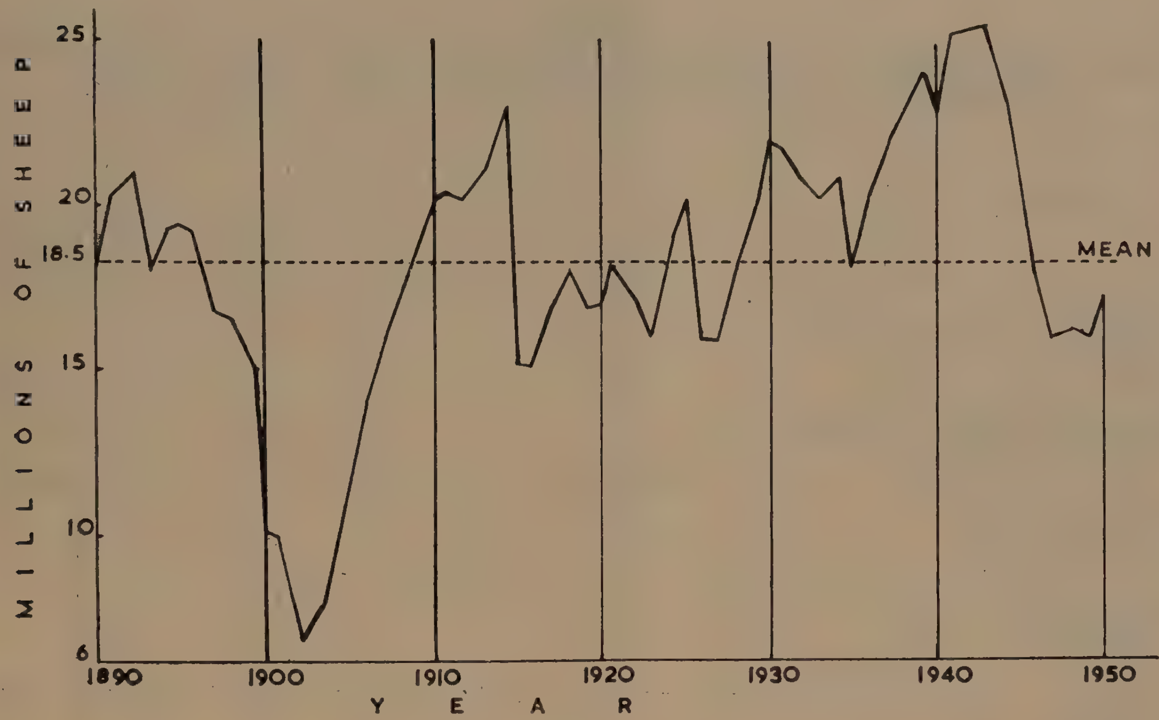


Figure 1.

Showing the changes in Queensland sheep population between 1890 and 1950.

The horizontal scale represents the years between 1890 and 1950, and the vertical scale the number of sheep in millions between the limits of 7 and 25 millions. The line drawn at 18.5 millions represents the mean sheep population, about which the figures for the various years are distributed.

have been due to lack of water, while those in the 1946-48 drought were due to lack of feed. However, during the more recent droughts, more modern methods of transport facilitated the removal of a large number of sheep from drought stricken areas.

The occurrence and intensity of drought in Queensland has varied on a regional basis. The frequency and succession of bad and/or light years is higher for those centres further from the coast than for those in the more favoured areas of the Darling Downs and the Central Highlands.

Table 1 indicates the number of years (between 1916 and 1936) during which the drought losses in various districts were a certain percentage of the total flock of the previous year. For example, there were nine years between 1916 and 1936 during which properties in the Burke district suffered drought losses between 5 per cent. and 10 per cent. of the previous year's flock numbers.

It is seen that the percentage of drought losses has been higher in the north-western than in the southern part of the State. Figure 2, which has been drawn from Table 1, also makes this perfectly clear.

The figures given in the table are not a reflection of the severity of the seasons alone. Other factors have played a part. For instance, the occurrence of valuable edible trees, such as mulga, has greatly reduced the effects of adverse seasons in the Warrego pastoral district, whereas the lack of top feed in the Mitchell, Burke and Gregory districts accentuates the problem of keeping sheep alive during drought time.

TABLE 1.

SHOWING THE NUMBER OF OCCASIONS ON WHICH DROUGHT LOSSES IN EACH DISTRICT ATTAINED DIFFERENT LEVELS BETWEEN THE YEARS 1916 AND 1936.

District.	Percentage Drought Loss.								
	Under 1.	1–5.	5–10.	10–15.	15–20.	20–25.	25–30.	30–35.	35–40.
BURKE .. .. (Cloncurry, Richmond)	3	4	9	2	..	1	..	1	..
GREGORY NORTH .. (Boulia, Winton)	4	5	5	4	..	1	..	..	1
GREGORY SOUTH .. (Windorah)	2	8	5	1	2	1	..	..	..
LEICHHARDT .. (Emerald, Clermont)	2	11	5	..	1	1	..	..	..
MARANOA .. .. (Mitchell, Roma)	3	8	8	1	..	..	..	..	..
MITCHELL .. .. (Longreach, Barcaldine)	4	6	7	1	1	..	1	..	..
SOUTH KENNEDY .. (Alpha)	4	9	4	1	1	..	..	..	1
WARREGO .. .. (Charleville, Cunnamulla)	3	8	7	2	..	..	..	..	..

The names of important towns in each district are indicated.

HOW FLOCKS GROW.

The rebuilding of flocks depleted by drought is one of the greatest difficulties facing woolgrowers in the north-west, because lamb-marking percentages are lower in that area than in the southern part of the State. This is borne out by Table 2, which shows the number of years in which the lamb-marking percentage was within certain limits in the various pastoral districts between 1918 and 1936. (The lamb-marking percentage is the percentage of lambs marked to ewes marked.) The table indicates, for example, that there were three years during which the lamb-marking percentages were between 60 and 65 in the Warrego district. It can also be seen that the lamb-marking percentages are consistently higher in the Maranoa and Warrego districts and consistently lower in the Burke district. The information contained in Table 2 is presented pictorially in Figure 3.

Two other factors influence the growth of flocks. These are:—

(1) The death rate.

(2) The policy set by woolgrowers in relation to classing, mating and casting for age.

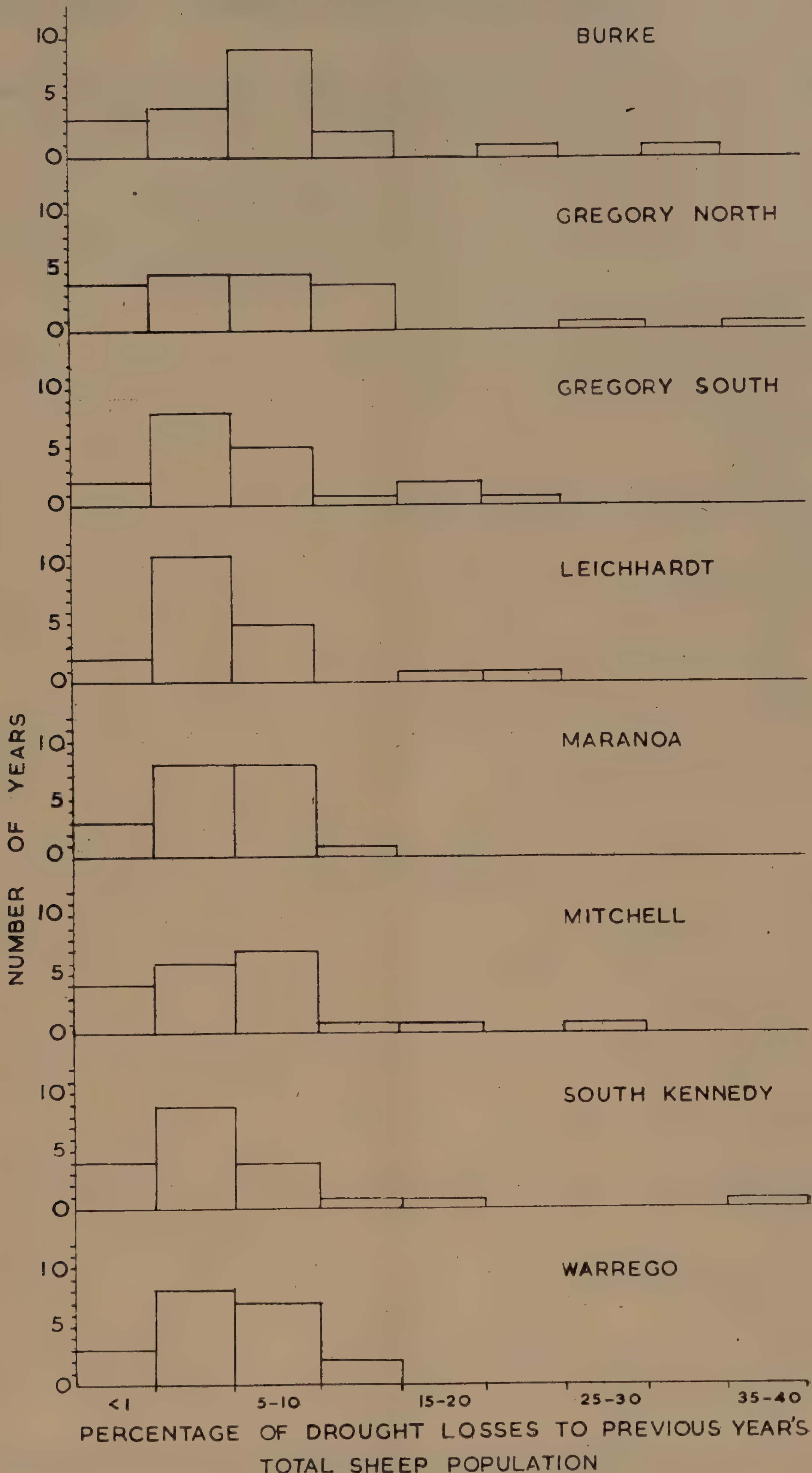


Figure 2.

Showing the distribution of drought losses experienced in the various pastoral districts between 1917 and 1936.

The horizontal scale represents the percentage of drought losses to the previous year's total sheep population. The vertical scale is divided into eight similar sections, each section representing the number of years for the

TABLE 2.

SHOWING THE NUMBER OF OCCASIONS ON WHICH DIFFERENT LAMB-MARKING PERCENTAGES WERE OBTAINED IN THE VARIOUS PASTORAL DISTRICTS BETWEEN 1918 AND 1936.

District.	Percentage of Lambs Marked.						
	5–10.	10–15.	15–20.	20–25.	25–30.	30–35.	35–40.
BURKE .. .. (Cloncurry, Richmond)	..	..	2	1	1	2	1
GREGORY NORTH .. .. .. (Boulia, Winton)	..	2	1	..	1	2	2
GREGORY SOUTH .. .. .. (Windorah)	..	..	..	..	3	1	2
LEICHHARDT .. .. .. (Emerald, Clermont)	..	..	1	1	1	..	1
MARANOA .. .. (Mitchell, Roma)	..	..	..	..	..	..	1
MITCHELL .. .. (Longreach, Barcaldine)	..	..	..	1	1	1	1
SOUTH KENNEDY .. .. .. (Alpha)	1	1	..	1	..	..	..
WARREGO .. .. (Charleville, Cunnamulla)	..	..	..	..	..	2	1
District.	Percentage of Lambs Marked.						
	40–45.	45–50.	50–55.	55–60.	60–65.	65–70.	70–75.
BURKE .. .. (Cloncurry, Richmond)	7	2	..	3	..	..	..
GREGORY NORTH .. .. .. (Boulia, Winton)	4	3	1	2	1	..	..
GREGORY SOUTH .. .. .. (Windorah)	4	2	2	3	2	..	..
LEICHHARDT .. .. .. (Emerald, Clermont)	2	3	4	4	2	..	..
MARANOA .. .. (Mitchell, Roma)	1	4	3	4	6	..	..
MITCHELL .. .. (Longreach, Barcaldine)	2	3	6	2	2	..	..
SOUTH KENNEDY .. .. .. (Alpha)	1	2	4	5	2	1	1
WARREGO .. .. (Charleville, Cunnamulla)	1	2	2	5	3	3	..

The average annual percentage losses in the pastoral districts between 1916 and 1936 were:—

Burke	16.3	Gregory North	16.5
Gregory South ..	14.2	Leichhardt	15.0
Maranoa	11.0	Mitchell	13.5
South Kennedy ..	16.0	Warrego	12.0

(All losses expressed as a percentage of the total sheep.)

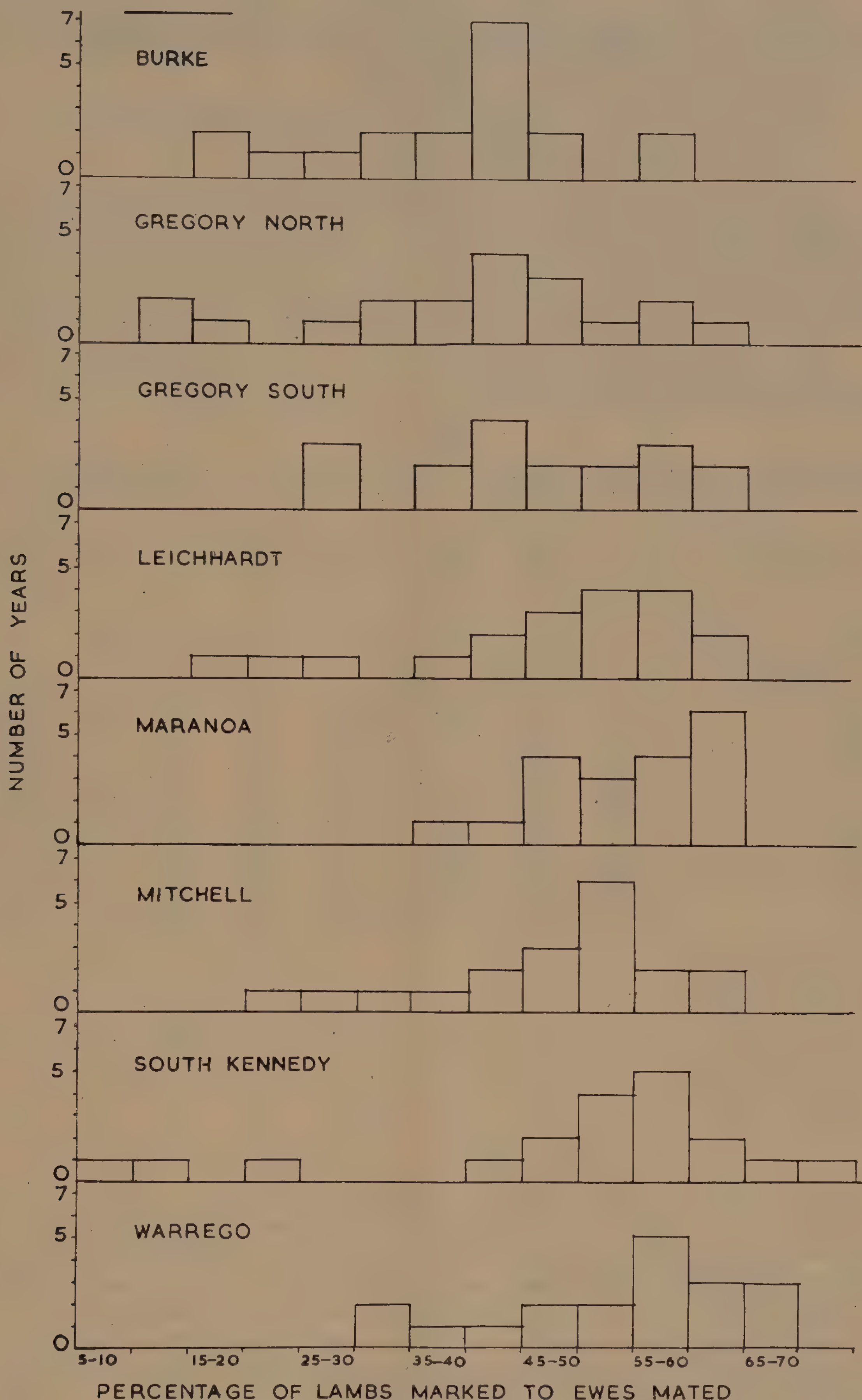


Figure 3.

Showing the distribution of different lamb-marking percentages in the various pastoral districts between 1918 and 1936.

The horizontal scale represents the percentage of lambs marked to ewes mated. The vertical scale is divided into eight sections, each representing the number of years for the district named.

It was shown in a previous article that the percentage of young ewes that can be culled from a breeding flock is governed by:—

(1) The lamb-marking percentage.

(2) The number of times a ewe is joined in her lifetime.

(3) The death rate in the flock.

The number of times ewes are joined in their lifetime is not available from the returns submitted. However, if the average death rates recorded in each district can be taken as applying to the breeding ewe flocks, it is possible to work out the number of matings which can be obtained in any number of years from 1,000 ewes in each district.

The results obtained by doing this are presented in Table 3, which is based on the assumption that the ewes are bred each year for 10 years.

TABLE 3.

SHOWING THE NUMBER OF MATINGS OBTAINED FROM 1,000 YOUNG EWES IN EACH PASTORAL DISTRICT, ALLOWING AVERAGE DEATH RATES.

Pastoral District.	Burke.	Gregory North.	Gregory South.	South Kennedy.	Leichhardt.	Mitchell.	Warrego.	Maranoa.
Average percentage loss	16·3	16·5	14·2	16·0	15·0	13·5	12·0	11·0
Year of Mating								
1st	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000
2nd	837	835	858	840	850	865	880	890
3rd	701	697	733	706	723	747	774	791
4th	586	581	628	592	614	643	680	703
5th	488	484	537	496	522	555	598	624
6th	407	404	458	416	443	479	525	554
7th	341	337	392	349	376	413	461	493
8th	285	282	335	293	320	357	405	438
9th	238	235	287	246	272	308	356	389
10th	199	196	246	206	231	266	315	346
Total number of matings from the original 1,000 ewes in 10 years	5,082	5,051	5,474	5,144	5,351	5,633	5,994	6,228
Average number of matings per ewe in her lifetime ..	5·1	5·1	5·5	5·1	5·4	5·6	6·0	6·2

It is fully realised that the assumption that the sheep would be mated only once per year in the Burke, Gregory, South Kennedy and Leichhardt pastoral districts does not apply to all properties in those areas. It is well known that some flocks would not be mated in dry seasons, while others would be mated twice during bounteous years. It is also known that it would only be in exceptional circumstances that ewes would be kept until they were 10 or 12 years old in the Maranoa and Warrego districts. The necessity for this could arise where a selector was desirous of increasing the size of his flock or when it was necessary to build up a flock after severe drought losses.

However, supposing the flocks in each district are bred once a year for seven years, and that average losses are experienced, the way in which the flocks will grow is shown in Figure 4. It is assumed that each flock consists of 100 ewes at the time of the first mating. Actual figures can be calculated by simple multiplication.

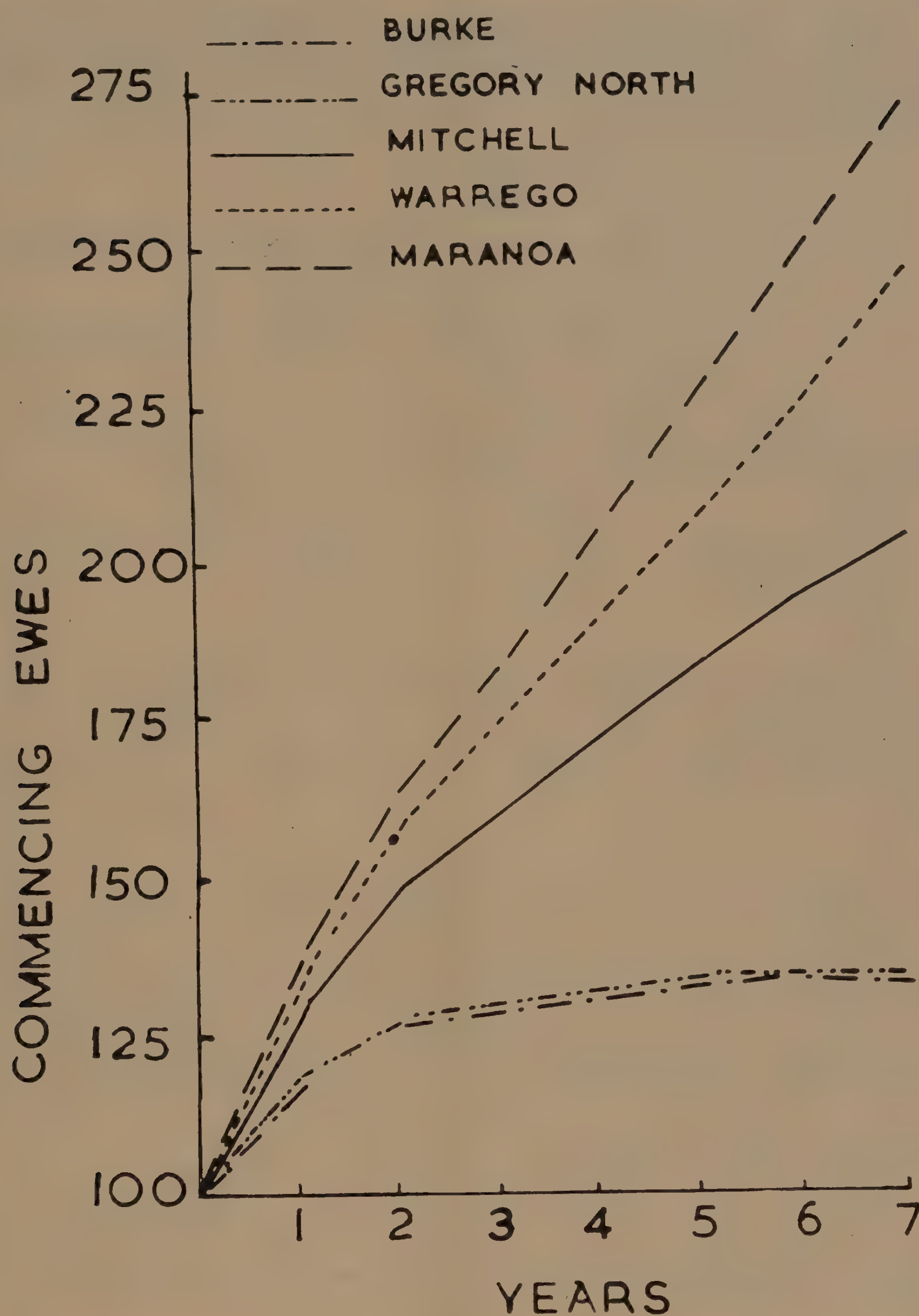


Figure 4.

Showing the way in which ewe flocks would increase in the various pastoral districts given average losses and lamb-marking percentages and allowing no culling.

The horizontal scale represents the number of years over which the ewes are bred, assuming mating once a year. The vertical scale represents the number of ewes present in the various flocks. In all districts the number of ewes at the commencement is taken as 100; curves rise from this point until after seven years the last point represents the total number in the flock.

It can be seen from the graph that in the Burke and Gregory North districts there is an initial slight increase until after two years the total number of ewes in the flock is about 125. In the next five years the total number of ewes increases to only about 130. This is due to (1) high annual death rate, (2) low lamb-marking percentages, and (3) heavy drought losses. On the other hand, flocks in the Mitchell, Warrego and Maranoa districts show a gradual increase until values of 200, 250 and 275 respectively are reached at the end of seven years.

From a consideration of such data it is possible to calculate the percentage of young ewes which would have to be selected at classing time to maintain flock numbers. Using the data available from Table 3, and applying the formula

$$S = \frac{2{,}000{,}000}{M \times n \times (100 - d)}$$

where S = the percentage of young sheep to be selected,
M = the lamb-marking percentage,
n = the average number of matings obtained from a ewe in her lifetime,
d = average annual death rate,

and substituting average values for M, n and d which apply to each pastoral district, the following values for S are obtained:—

Burke	117%	Gregory North ..	115%
Gregory South ..	92%	Leichhardt ..	92%
South Kennedy ..	93%	Mitchell	83%
Warrego	73%	Maranoa	67%

This makes it perfectly obvious that it is impossible to maintain flock numbers in the Burke and North and South Gregory districts without resorting to double lambings. It is also difficult to maintain flock numbers in the Leichhardt and South Kennedy districts, although, if the ewes are bred right out, 7-8 per cent. of young sheep could be culled.

In the Mitchell, Warrego and Maranoa districts, it would be possible to cull more heavily and to cast the ewes earlier.

Actually, the position may not be quite as bad as is indicated by the figures presented. Statistics pertaining to the performance of flocks in the pastoral districts are available for only a comparatively short period and in any case a pastoral district is far too large a unit with which to work. A more precise picture of the position could be obtained from figures collected on a shire basis. In addition, the period 1916-1936 included a number of severe droughts and these tended to increase losses and decrease lambings.

Actually, if the one-third of the records constituting the lowest number of lambings recorded in each district are excluded from those presented in Table 2, the mean lamb-marking percentage for each district is increased as shown in Table 4.

TABLE 4.

SHOWING AVERAGE LAMB-MARKING PERCENTAGES IF THE LOWEST ONE-THIRD IS NEGLECTED.

District.	Original for M.	Value of M if lowest One-third is Neglected
Burke	40·1	45·7
Gregory North	41·0	47·0
Gregory South	46·9	52·6
Leichhardt	48·2	54·5
Maranoa	54·3	58·0
Mitchell	49·0	54·0
South Kennedy	51·1	58·0
Warrego	52·3	55·2

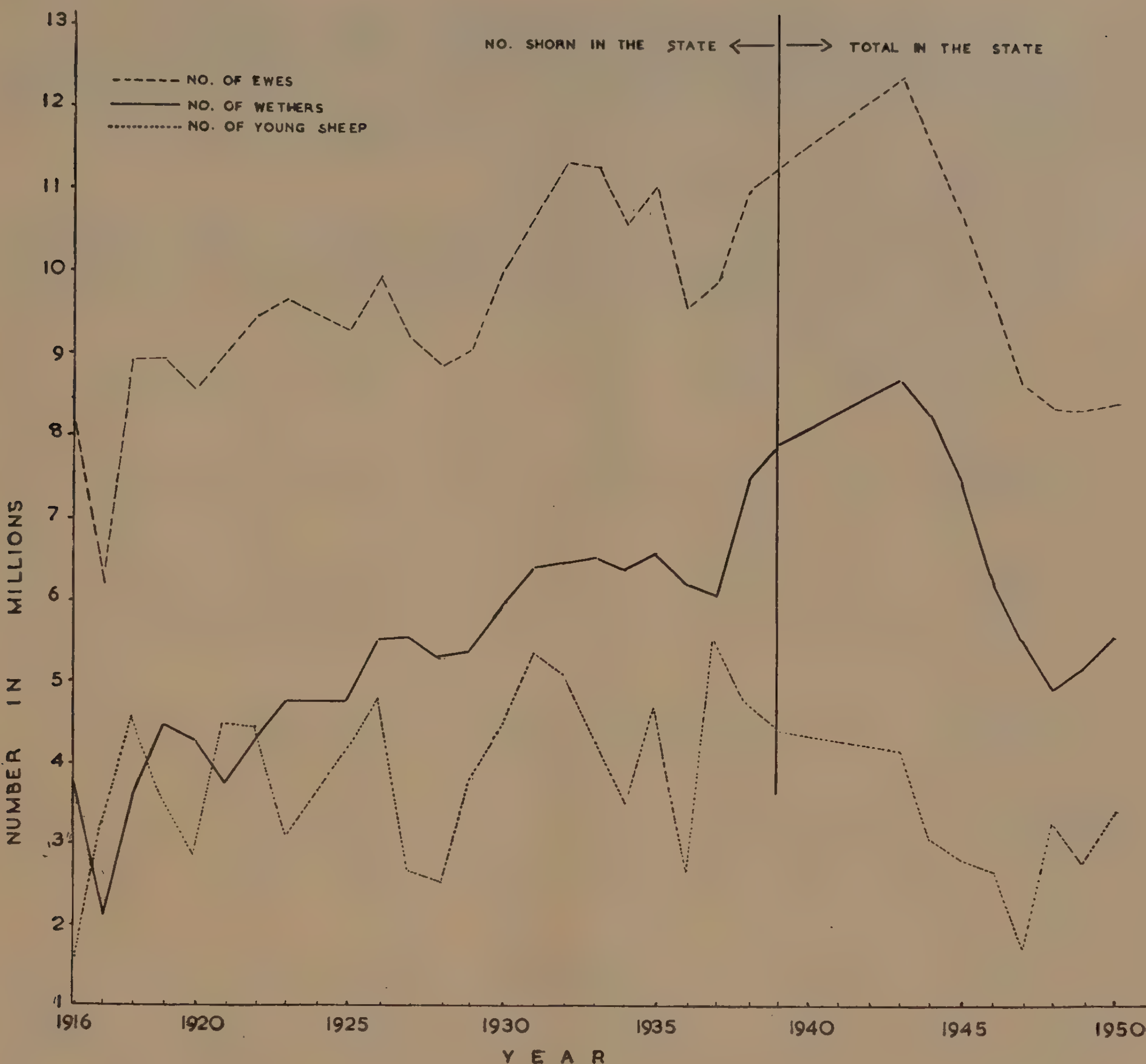


Figure 5.

Showing the composition of Queensland's flock on a sex and age basis from 1916 to 1950.

The horizontal line represents the years between 1916 and 1950 for which statistics were collected. The vertical scale shows the numbers in millions.

This would necessitate neglecting the figures for three consecutive years for one district, but it makes it clear that a run of two or three good years assists in maintaining numbers.

This raises questions as to how the State's flock grows. A dissection of the State's flock on a sex and age basis is shown in Figure 5, from which it is clear that most of the important increases in sheep population have been due to the holding of old sheep. This was most noticeable in 1928, 1931 to 1933, and 1937 to 1942, and might be related partly to the number of cull or cast-for-age ewes which each property has for sale. It is well known that small lines of sheep of this class do not command strong competition in the central-west and north-west. It may also be due to the fact that during favourable years it is difficult to obtain enough sheep to meet the stocking requirements of a property or district. If a series of good years occur, woolgrowers tend to hold old sheep and let flock numbers increase. One outstanding exception to this, of course, was in the late 'twenties and early 'thirties, when seasonal conditions were not particularly favourable but flock numbers increased considerably. This was probably due to the financial policy adopted at the time.

HOW LONG SHOULD SHEEP BE KEPT.

Woolgrowers usually do not like to hold ewes until they attain the age of eight or nine years. The reasons for this might be summarised as follows:—

1. The sale value of old ewes is low.
2. Mortality amongst old ewes is always heavy during dry years.
3. Higher losses are experienced amongst old ewes during lambing than amongst flocks comprising younger ewes.

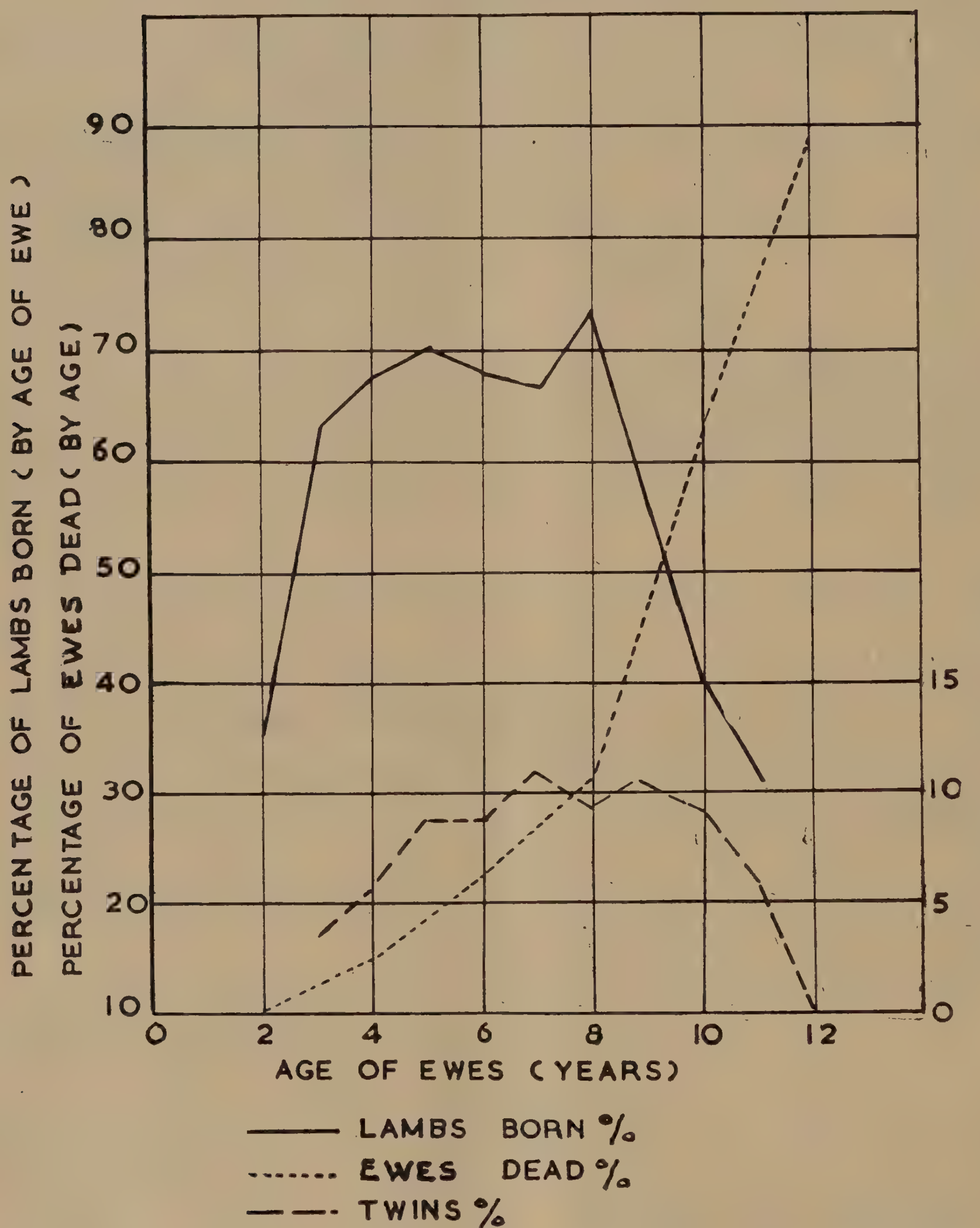


Figure 6.

Showing the relationship between fertility, twinning, mortality and age.

The horizontal scale represents the age of the ewes. There are two vertical scales. That on the left represents both the percentage of lambs born and the percentage of ewes which died and refers to the unbroken and the dotted lines of the graph. That on the right represents the percentage of twins and applies to the broken line of the graph.

It can be seen that after ewes have attained the age of eight, the following occur:—(1) rapid decrease in fertility, (2) rapid increase in mortality of lambs, and (3) rapid decrease in twinning.

(Figure after R. B. Kelley.)

4. The cut per head of old ewes is lower than that of younger ewes.
5. Fewer lambs are marked from flocks of older ewes than from flocks of younger ewes.

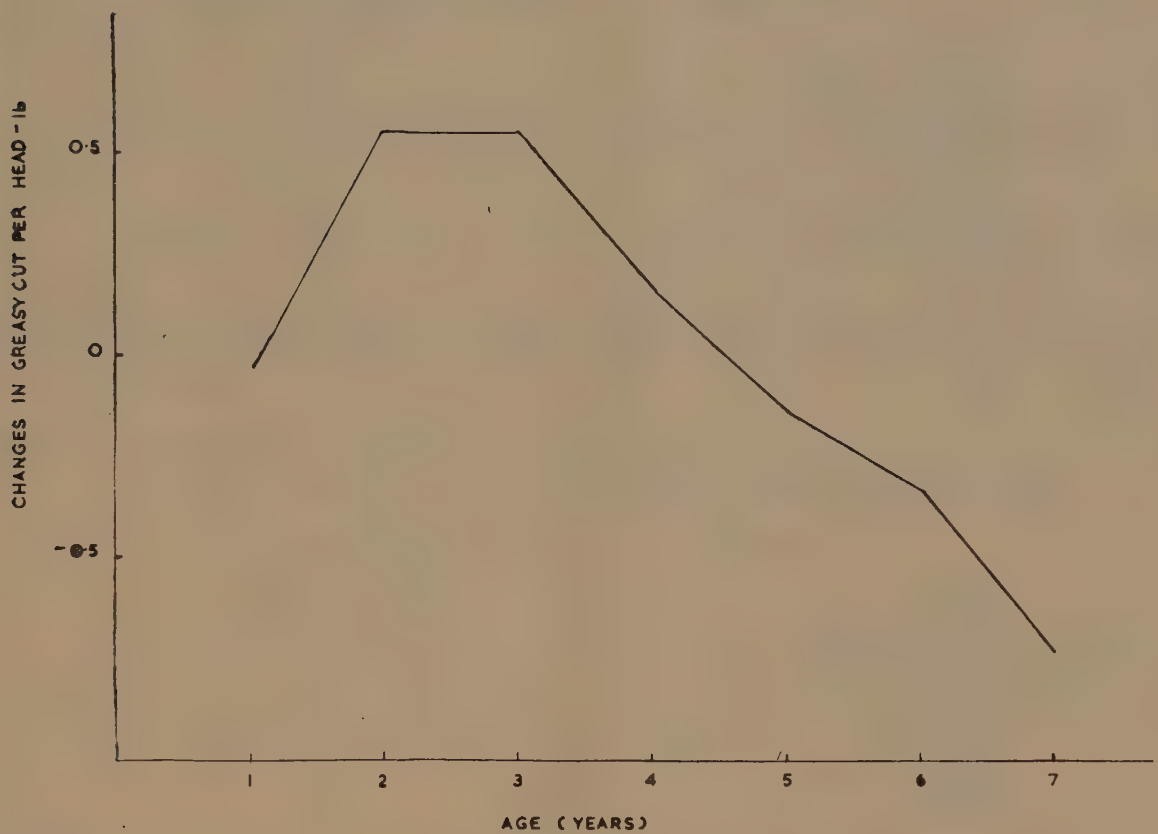


Figure 7.

Showing the change in cut per head for ewes of various ages.

The horizontal scale represents the age of the ewes and the vertical scale the change in pounds of greasy cut per head. The value of the cut per head when the ewes are one year old is taken as the base line and represented at O on the vertical scale.

When the flock is two years old the average greasy cut per head is about 0.6 lb. more than at one year old. It can also be seen that by the time the ewes are five years old the average greasy cut per head is about 0.2 lb. less than at one year old, and when the ewes are seven years old the cut per head is about 0.75 lb. less than at one year old.

(Figure and data from Miss H. Turner; presented at Sheep and Wool Extension Workers' Conference, September, 1951.)

Some idea of the extent to which age affects the productivity of sheep can be determined from Figures 6 and 7, which show the lambings and losses of ewes on an age basis and the cut per head of ewes in relation to their age. These figures indicate that the productivity of sheep decreases as their age increases, and that in the majority of circumstances it is preferable to cast sheep after they have passed their eighth year.

The possibilities of casting ewes after their eighth year can be calculated by turning the formula—

$$S = \frac{2,000,000}{M \times n \times (100 - d)}$$ around so that—

$$n = \frac{2,000,000}{S \times M \times (100 - d)}.$$

Suppose it is agreed that no classing will be done so that S will have a value of 100—that is, all young ewes will be selected into the flock. By substituting the values for M and d which pertain to each pastoral district, the values for n shown in Table 5 are obtained.

TABLE 5.

SHOWING THE AVERAGE NUMBER OF MATINGS TO BE OBTAINED FROM EACH EWE IF FLOCK NUMBERS ARE TO BE MAINTAINED, GIVEN AVERAGE DEATH RATES AND LAMB-MARKING PERCENTAGES AND ALLOWING NO CULLING.

District.	Value of n.
Burke	5·2
Gregory North	5·1
Gregory South	4·4
Leichhardt	4·3
Maranoa	3·9
Mitchell	4·3
South Kennedy	4·1
Warrego	4·1

By comparing this result with Table 3, it is seen that the ewes would be kept until they had been mated as shown in Table 6.

TABLE 6.

SHOWING THE NUMBER OF TIMES FLOCKS WOULD HAVE TO BE MATED TO SECURE THE AVERAGE NUMBER OF MATINGS PER EWE SHOWN IN TABLE 5.

District.	No. of Times Mated.
Burke	More than 10
Gregory North	More than 10
Gregory South	7
Leichhardt	7
Maranoa	5
Mitchell	7
South Kennedy	7
Warrego	6

Actually, it would be necessary to extend Table 3 to determine the number of times ewes in the Burke and Gregory North pastoral districts would have to be mated. If this is done, the following results are obtained:—

District	No. of Times Mated.
Burke	11
Gregory North	11

This means that ewes breeding for the eleventh time would be 13 years old by the time the lambing was completed. At this age they have lost nearly all their sale value.

If the desirable practice of culling 25 per cent. of young sheep is to be followed, S has a value of 75 per cent. and the values of n and the number of times the sheep would be mated to give this value for each district would be as shown in Table 7.

TABLE 7.

SHOWING THE AVERAGE NUMBER OF MATINGS (n) TO BE OBTAINED FROM EACH EWE AND THE NUMBER OF TIMES FLOCKS WOULD HAVE TO BE MATED TO SECURE THIS TO ALLOW FOR A 25 PER CENT. CULLING WITH AVERAGE DEATH RATES AND LAMB-MARKING PERCENTAGES.

District.	n.	No. of Times the Flock Would Have to be Mated.
Burke	7·0	More than 20
Gregory North	6·8	More than 20
Gregory South	5·8	12
Leichhardt	5·8	13
Maranoa	5·2	8
Mitchell	5·7	11
South Kennedy	5·5	13
Warrego	5·5	9

It can be seen from Table 7 that it would be impossible to mate the ewes a sufficient number of times to obtain values of 7 and 6.8 for n in the Burke and Gregory North districts respectively. This means that to maintain flocks in these districts, and also in the Leichhardt, Gregory South and South Kennedy districts, culling 25 per cent. of young sheep is impracticable.

These figures have been obtained from applying the method used in compiling Table 6, although it has been necessary to extend the table to obtain the number of times the flock would have to be mated.

It would be impossible to obtain sufficient matings from the sheep in some districts, but there is the possibility that the position could be improved by increasing lamb-marking percentages. The value of M (that is, the average lamb-marking percentages) can be determined by turning around the formula:—

$$S = \frac{2{,}000{,}000}{M \times n \times (100 - d)} \text{ so that}$$

$$M = \frac{2{,}000{,}000}{S \times n \times (100 - d)}.$$

If a value of 90 or 75 is assigned to S for flocks in the various pastoral districts, as shown in Table 8, it means that a 10 per cent. culling is practised in flocks in the northern group of districts and 25 per cent. culling is practised in the south.

TABLE 8.

SHOWING VALUES ASSIGNED TO S AND THE CULLING RATES FOR THE VARIOUS PASTORAL DISTRICTS.

S = 90 (10% Culling).	S = 75 (25% Culling).
Burke	Mitchell
Gregory North	Warrego
Gregory South	Maranoa
South Kennedy	
Leichhardt	

Assuming the ewes in the northern districts are cast for age after the flock has been mated once a year for eight years, and those in the remaining districts are cast after the flock has been mated once a year for five years, the values for M shown in Table 9 will be obtained.

TABLE 9.

SHOWING THE AVERAGE LAMB-MARKING PERCENTAGES THAT WOULD HAVE TO BE MAINTAINED IN EACH PASTORAL DISTRICT TO ALLOW SOME CULLING AND CASTING FOR AGE BEFORE THE EWES LOSE THEIR RESALE VALUE.

District.	Lamb-marking Percentage Which Would Have to be Maintained.
Burke	57·8
Gregory North	58·1
Gregory South	53·2
South Kennedy	56·4
Leichhardt	54·7
Mitchell	81·6
Warrego	78·1
Maranoa	75·2

These figures are calculated from values for n obtained from Table 3.

These considerations make it clear that lowered lamb-marking percentages constitute one of the most important biological problems facing the sheep industry in Queensland. Apart from retarding the rate at which flocks can be rebuilt, they are reducing the efficiency with which wool can be produced and are impeding the rate at which genetic progress can be made.

The cut per head of sheep in the northern part of the State, where very little culling can be practised, is lower than that of sheep in the south, where more culling can be undertaken. While quite a number of other factors may be contributing to this difference, greater productivity per sheep can be anticipated in those flocks in which culling is undertaken.

The other important way in which lowered lamb-marking percentages affect the productivity of animals is through their influence on generation length. In flocks which enjoy high reproduction rates, the generation length is shorter than in those in which the reproduction rates are low. The rate at which genetic improvement is attained is largely influenced by generation length.

It is important, therefore, to reduce generation length as much as possible by maintaining lamb-marking percentages at as high a level as is practicable.

HOW THE COMPOSITION OF FLOCKS CHANGES.

The balance between lamb-marking percentages and losses is one of the most important factors influencing the composition of flocks and the husbandry practices followed. Table 10 shows the percentage of ewes bred to total flock in the pastoral districts for the 19 years, 1918-1936.

TABLE 10.

SHOWING THE PERCENTAGE OF EWES BRED TO TOTAL FLOCK.

Pastoral District.	More than 50% of Total Flock.	Between 40% and 50% of Total Flock.	Less than 40% of Total Flock.
Burke	2	16	1
Gregory North	6	13	0
Gregory South	10	6	3
Leichhardt	1	0	18
Maranoa	0	7	12
Mitchell	2	13	4
South Kennedy	0	2	17
Warrego	1	17	1

These figures reflect the effect of seasonal conditions on reproduction rates and the composition of flocks. Owing to the difficulty of maintaining flock numbers, a higher proportion of ewes has been carried in the northern districts than in the more favoured Maranoa district.

In districts where reproduction rates are low, it has become necessary to preserve as many ewes as possible so as to be able to maintain numbers. This trend is demonstrated in the maps in Figures 8-10, which show the changes in the proportion of wethers to breeding ewes in the various shires between 1944-45 and 1949-50.* Of the shires in which sheep breeding predominates, the greatest changes have occurred in Murweh, Paroo and Quilpie in the South-Western statistical division and in McKinlay, Flinders and Wyangarie in the North-Western division. A summary of these is shown in Table 11.

* NOTE.—The following areas are excluded from the survey:—(*a*) The whole of the Moreton, Maryborough, Rockhampton, Mackay, Townsville, Cairns and Peninsula statistical divisions; (*b*) Etheridge, Croydon, Carpentaria, Burke and Barkly Tableland shires in the North-Western division; (*c*) Diamantina shire in the Far Western division; and (*d*) the easternmost shires of the Downs division.

TABLE 11.

SHOWING THE DECREASES IN DIFFERENT SHIRES IN NUMBER OF WETHERS TO 100 EWES FROM 1944–45 to 1949–50.

20.	20–40.	40–60.	60–80.	80 and Over.
Balonne	Bulloo	Wyangarie	Paroo	Booringa
Bungil	Aramac		Quilpie	Murweh
Warroo	Barcaldine		Flinders	Bauhinia
Cloncurry			McKinlay	Belyando
Blackall				Emerald
Ilfracombe				Jericho
Longreach				
Peak Downs				
Tambo				

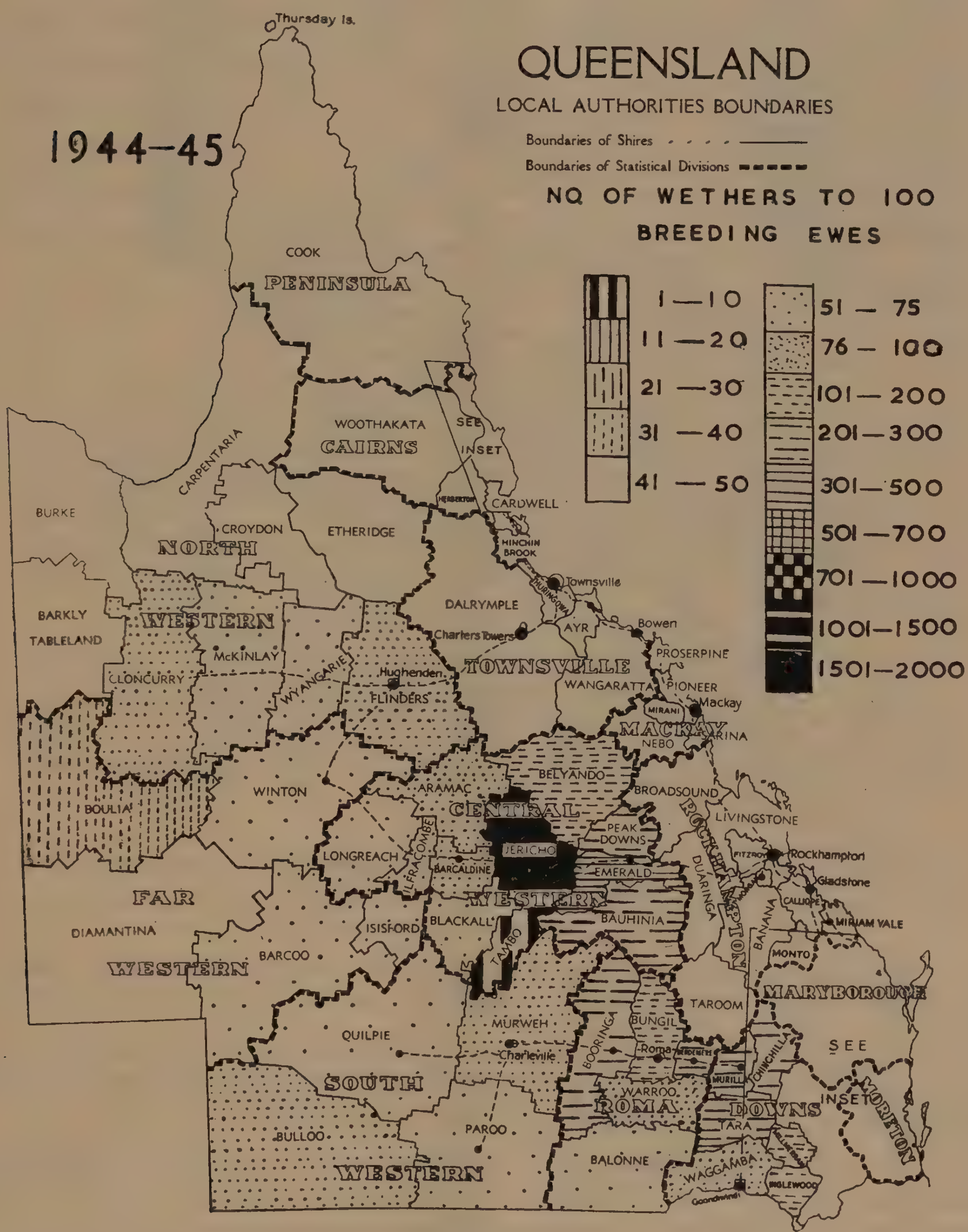


Figure 8.

Showing number of wethers to 100 breeding ewes for various shires in 1944-45. Shires are shaded according to the scale and changes in flock composition can be seen by comparing Figures 8, 9 and 10. (See footnote on p. 302.)

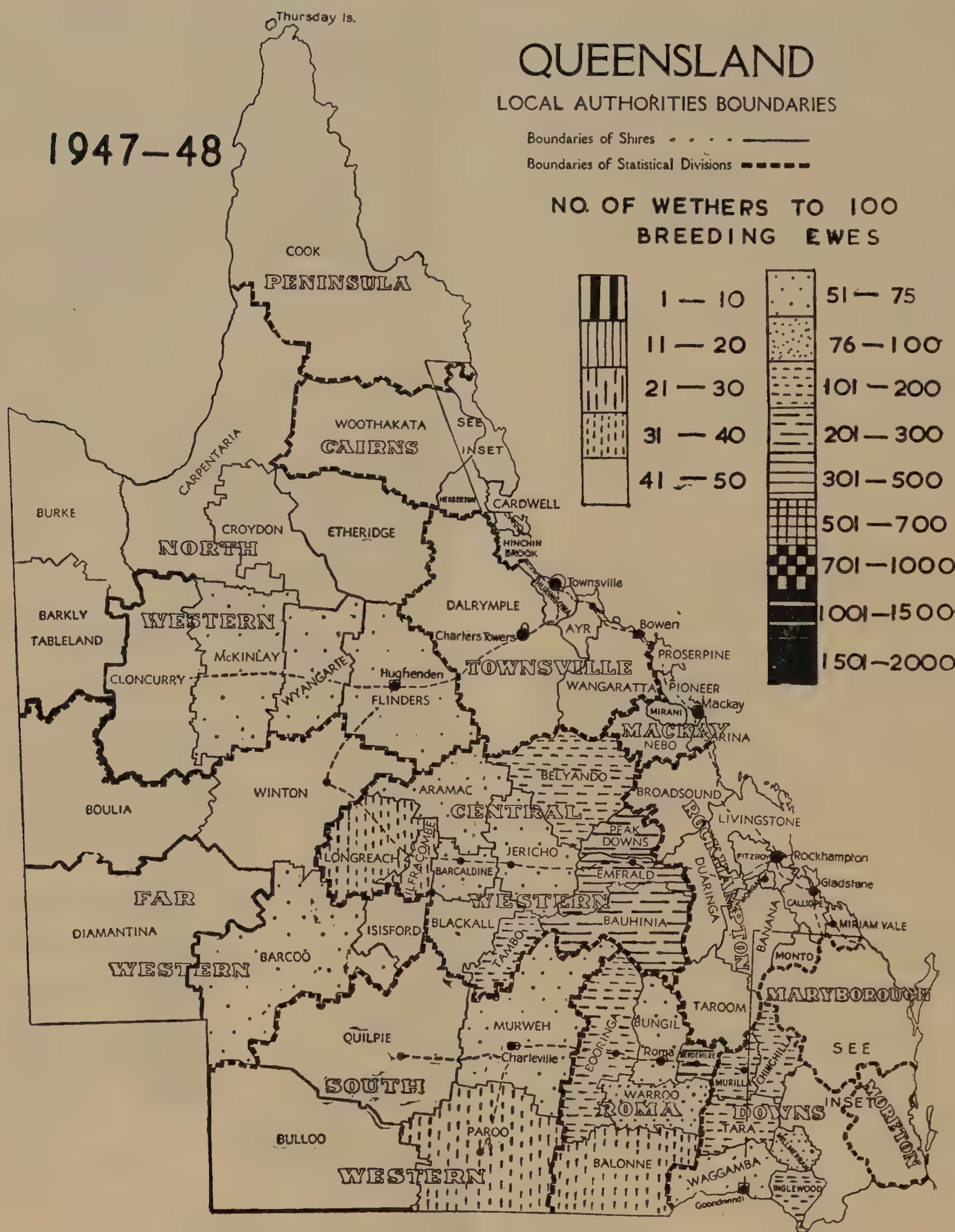


Figure 9.

Showing number of wethers to 100 breeding ewes for various shires in 1947-48. (See footnote on p. 302.)

Unfavourable seasons were experienced between 1940 and 1946 in the south-west but favourable conditions prevailed from 1947 to 1950.

In the greater part of the north-west favourable seasons occurred between 1941 and 1944 but drought conditions prevailed between 1946 and 1948. The 1949 and 1950 seasons were bounteous.

The marked decreases in the proportion of wethers to ewes in the north-west occurred as a result of the sale of this class of stock, which was necessary because of drought. That in the south-west occurred as a result of high reproduction rates during favourable seasons and a strong demand for wethers in southern markets.

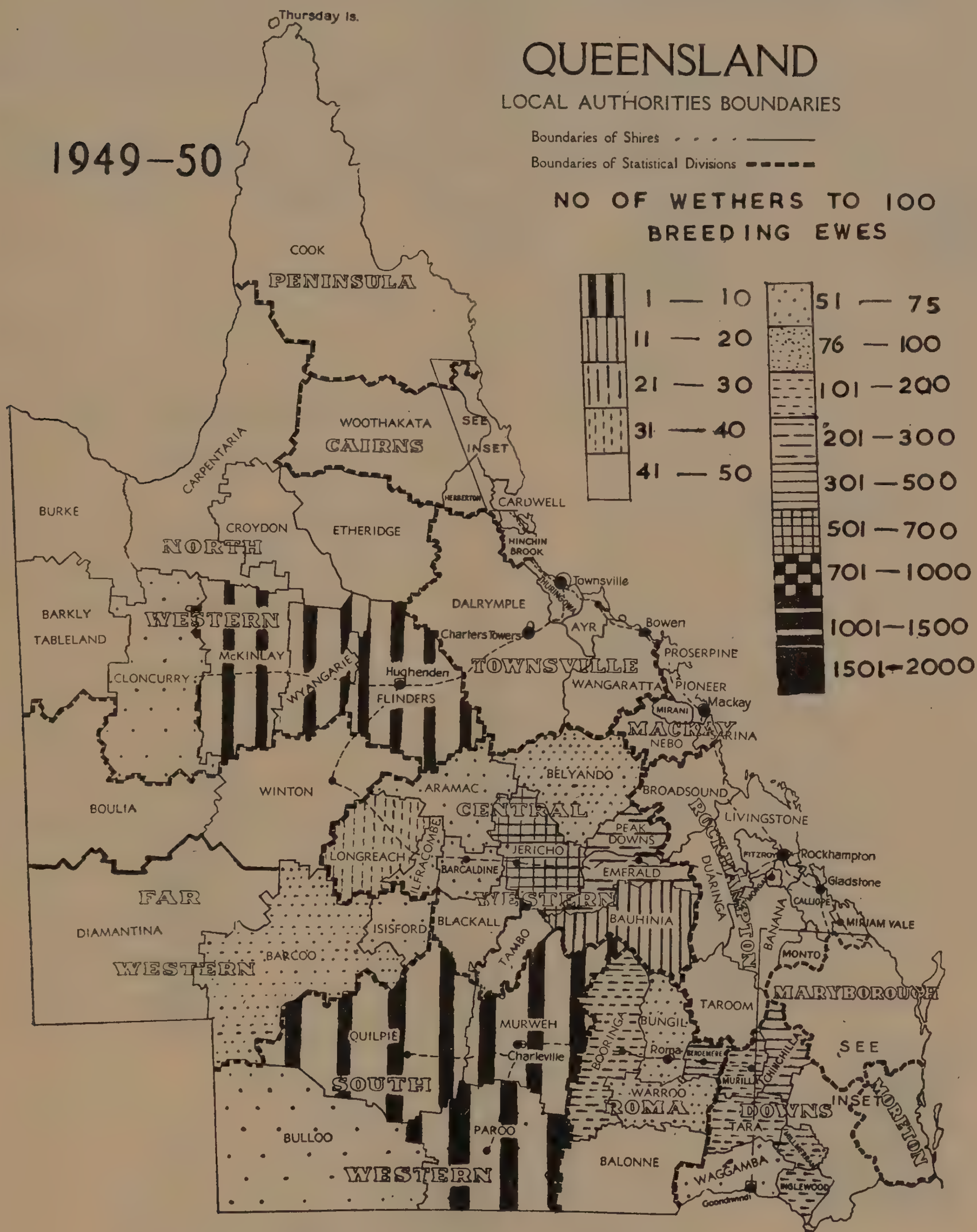


Figure 10.

Showing number of wethers to 100 breeding ewes for various shires in 1949-50. (See footnote on p. 302.)

The widest changes in the ratio of wethers to ewes occurred in the Belyando, Bauhinia, Booringa, Emerald and Jericho shires, which carry only a small number of breeding ewes. Drought losses and difficulty in obtaining surplus wethers from areas in which sheep breeding predominates have been responsible for these changes.

The maps showing the changes in the ratio of young sheep to ewes (Figures 11-13) indicate decreases between 1945 and 1950 in all shires except Balonne, Warroo, Bauhinia, Blackall and Ilfracombe.

The largest decreases are summarised in Table 12.

TABLE 12.

SHOWING THE DECREASES IN DIFFERENT SHIRES IN THE NUMBER OF YOUNG SHEEP TO 100 EWES FROM 1945–50.

20–30.	30–40.	40–60.	60–80.	80 and Over.
Quilpie Cloncurry Flinders Barcaldine	Wambo Paroo McKinlay Wyangarie Aramac	Waggamba Boulia Winton	Murweh	Bulloo

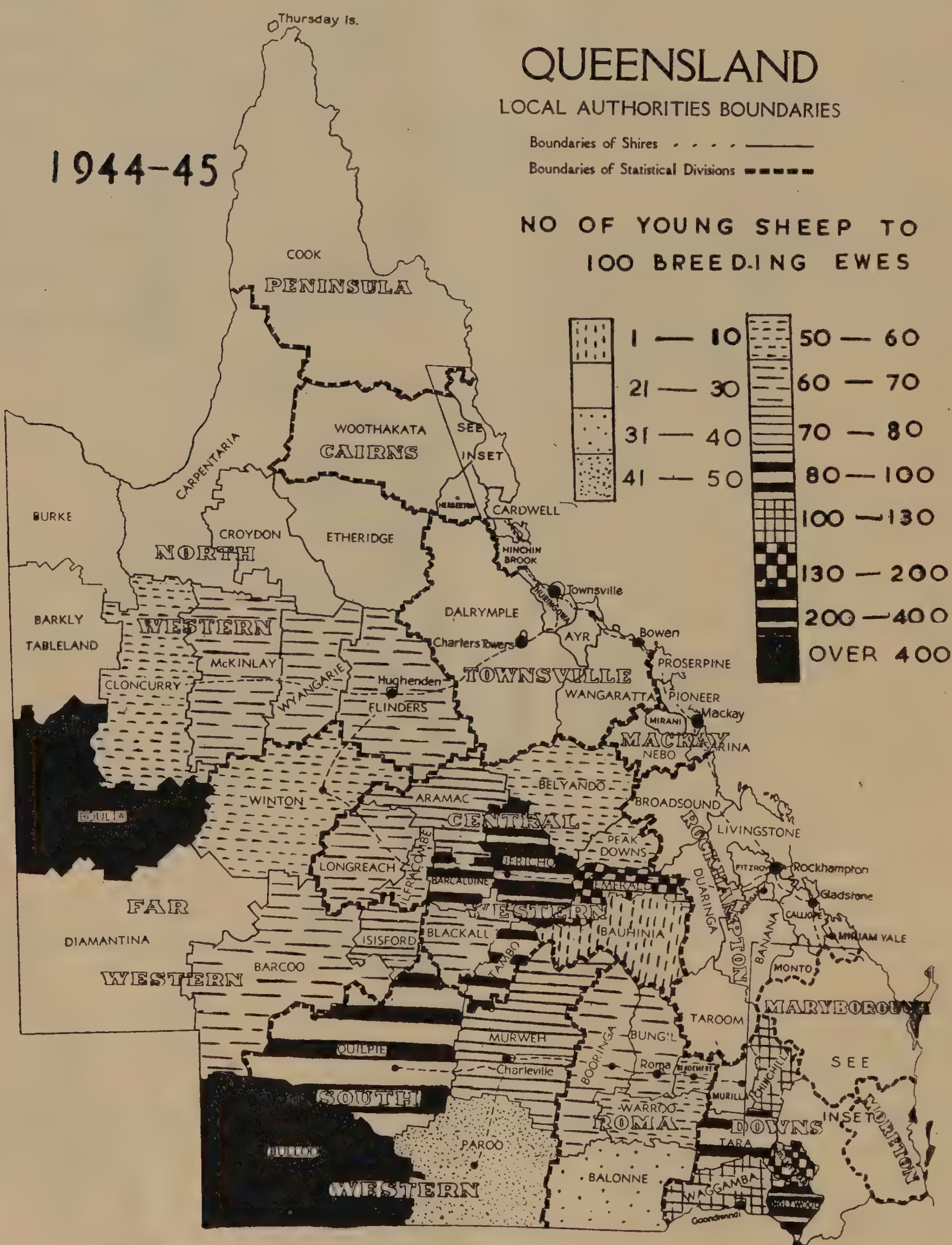


Figure 11.

Showing number of young sheep to 100 breeding ewes for various shires in 1944-45. Shires are shaded according to the scale and changes in flock coposition can be seen by comparing Figures 11, 12 and 13. (See footnote on p. 302.)

Those in the shires in the south-west are of particular interest because they reflect good seasons, more assured lambings and high market prices for sheep.

In the north-west and far west the proportion of young sheep is low on account of drought and low reproduction rates. In these divisions the proportion of young sheep is highest in the Winton shire.

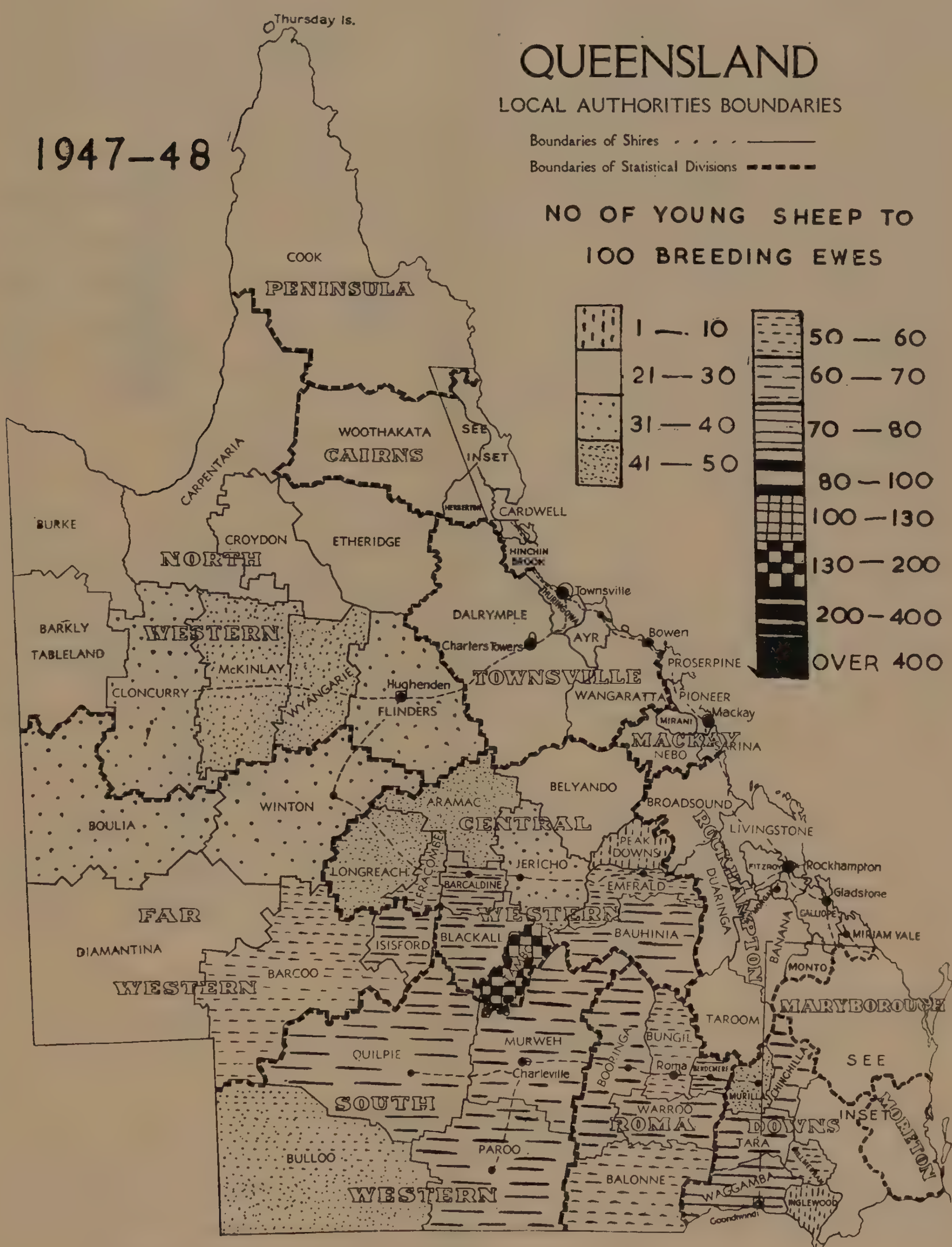


Figure 12.

Showing number of young sheep to 100 breeding ewes for various shires in 1947-48. (See footnote on p. 302.)

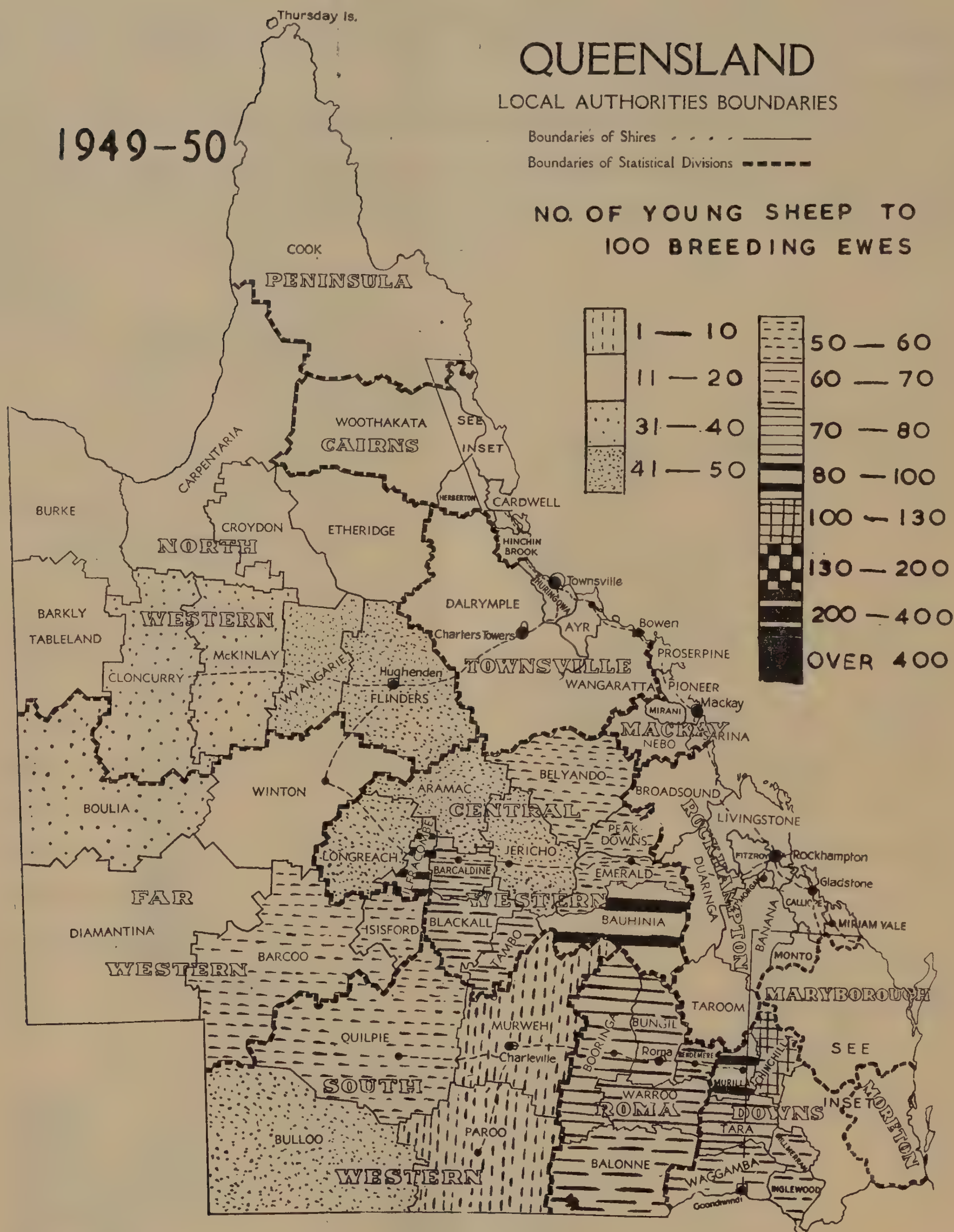


Figure 13.

Showing number of young sheep to 100 breeding ewes for various shires in 1949-50. (See footnote on p. 302.)

ACKNOWLEDGMENTS.

In preparing Parts 1 and 2 of this series use has been made of data published by Mr. W. Grainger and Mr. R. B. Kelley. Information made available by Miss H. Turner to the Sheep and Wool Extension Workers' Conference, which was held in Brisbane in September, 1951, has also been used.

Assistance has been rendered by members of the staff of the Sheep and Wool Branch in compiling tables and drawing maps, and this is gratefully acknowledged.

[*The concluding part of the series will appear in the June issue.*]

ASTRONOMICAL DATA FOR QUEENSLAND.

JUNE.

Supplied by W. J. NEWELL, Hon. Secretary of The Astronomical Society of Queensland.

TIMES OF SUNRISE AND SUNSET.

At Brisbane.			MINUTES LATER THAN BRISBANE AT OTHER PLACES.					
Day.	Rise.	Set.	Place.	Rise.	Set.	Place.	Rise.	Set.
	a.m.	p.m.						
1	6.30	5.00	Cairns	8	50	Longreach ..	26	43
6	6.32	5.00	Charleville	25	29	Quilpie	37	33
11	6.34	4.59	Cloncurry	36	63	Rockhampton ..	1	19
16	6.36	5.00	Cunnamulla ..	31	27	Roma	15	19
21	6.38	5.00	Dirranbandi ..	22	16	Townsville ..	8	42
26	6.39	5.02	Emerald	11	28	Winton	29	52
30	6.39	5.03	Hughenden ..	21	49	Warwick	5	3

TIMES OF MOONRISE AND MOONSET.

At Brisbane.

Day.	Rise.	Set.
	p.m.	
1	12·15	
		a.m.
2	12.43	12.17
3	1.12	1.11
4	1.44	2.07
5	2.20	3.06
6	3.01	4.09
7	3.50	5.16
8	4.48	6.23
9	5.53	7.30
10	7.03	8.30
11	8.14	9.22
12	9.23	10.07
13	10.29	10.47
14	11.31	11.22
15	..	11.55
	a.m.	p.m.
16	12.32	12.27
17	1.32	1.01
18	2.33	1.37
19	3.34	2.16
20	4.34	3.00
21	5.32	3.49
22	6.27	4.42
23	7.18	5.37
24	8.03	6.34
25	8.42	7.30
26	9.16	8.24
27	9.47	9.17
28	10.16	10.09
29	10.43	11.02
30	11.11	11.55
31	..	..

MINUTES LATER THAN BRISBANE (SOUTHERN DISTRICTS).

Charleville 27; Cunnamulla 29; Dirranbandi 19;
Quilpie 35; Roma 17; Warwick 4.

MINUTES LATER THAN BRISBANE (CENTRAL DISTRICTS).

Day.	Emerald.		Longreach.		Rockhampton.		Winton.	
	Rise.	Set.	Rise.	Set.	Rise.	Set.	Rise.	Set.
1	17	20	33	36	8	11	37	42
6	28	12	44	27	19	2	51	30
11	27	11	43	26	18	1	51	29
16	18	22	33	38	9	13	38	44
21	9	30	25	45	0	21	26	53
26	13	25	28	41	3	16	32	47
30	20	16	37	32	11	8	42	36

MINUTES LATER THAN BRISBANE (NORTHERN DISTRICTS).

Day.	Cairns.		Cloncurry.		Hughenden.		Townsville.	
	Rise.	Set.	Rise.	Set.	Rise.	Set.	Rise.	Set.
1	25	31	47	52	32	37	21	27
3	34	26	54	47	38	33	29	22
5	44	15	61	41	45	26	37	14
7	54	6	67	34	51	20	44	7
9	55	2	68	32	51	17	45	3
11	48	7	63	35	48	21	40	8
13	37	18	55	43	40	27	31	17
15	26	31	47	51	32	36	22	26
17	20	41	43	58	28	44	17	35
19	10	50	37	63	22	49	9	42
21	3	55	34	67	18	52	4	45
23	3	53	34	66	18	51	4	44
25	10	47	37	62	22	47	9	39
27	18	38	42	56	27	41	16	33
29	27	28	49	49	33	34	23	24
31	33	23	52	45	37	30	27	20

Phases of the Moon.—First Quarter, 1st June, 7.46 a.m.; Full Moon, 8th June, 3.07 p.m.; Last Quarter, 15th June, 6.28 a.m.; New Moon, 22nd June, 6.45 p.m.; First Quarter, 30th June, 11.11 p.m.

On 21st June at 9 p.m. the sun will reach its greatest angle north of the equator and will then rise and set between 25 and 27 degrees north of true east and true west respectively. On the 2nd, 15th and 29th the moon will rise and set approximately at true east and true west respectively.

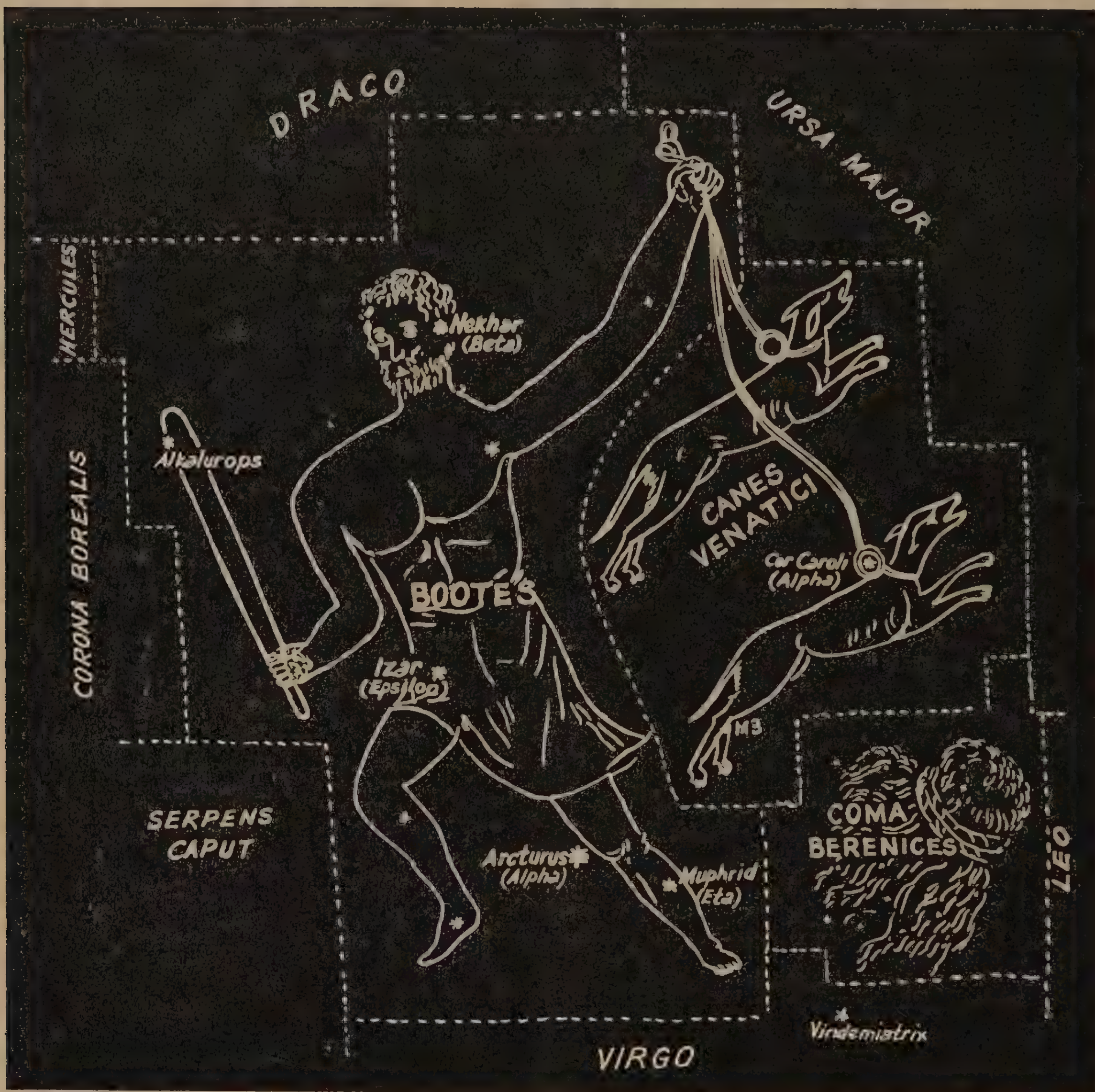
Mercury.—At the beginning of the month, in the constellation of Taurus, will rise ¾ hour before the sun. It will be in line with the sun on the 9th, after which it will pass into the evening sky, and by the end of the month, in the constellation of Cancer, will set 1½ hours after the sun.

Venus.—Now too close in line with the sun for observation.

Mars.—In the constellation of Virgo, will set between 3.30 a.m. and 4.45 a.m. on the 1st and between 1.45 a.m. and 3 a.m. at the end of June.

Jupiter.—Situated in the constellation of Aries, will rise about 2½ hours before the sun at the beginning of the month and between 2.30 a.m. and 3.45 a.m. at the end of the month. About the 18th the moon will be close to Jupiter.

Saturn.—The moon will be close to this planet on the 3rd. In the constellation of Virgo it will set between 1.45 a.m. and 3 a.m. on the 1st and near midnight at the end of the month.



THE CONSTELLATIONS.

BOOTES—THE HERDSMAN.

Old constellation figures show this group as a male figure holding in leash the hunting dogs of Canes Venatici and apparently about to unleash them after the Great Bear (Ursa Major). The most conspicuous object in the group is Arcturus (Alpha), a giant star with a diameter 25 times and luminosity 115 times that of our sun. Bootes is a large constellation reaching from declination 8 degrees north to about 55 degrees north and contains many double stars, including Delta, Epsilon, Zeta, Iota and Kappa.

CANES VENATICI—THE HUNTING DOGS.

Pictured as the hunting dogs Asterion and Chara held in leash by Bootes. Cor Caroli (Alpha) is the brightest star in this group and was named by Halley of comet fame. It is a double star, one of the pair being white and the other pale lilac. There are many extragalactic nebulae in this group, M51 being the larger of two such nebulae which appear almost in contact. It is known as the whirlpool nebula. About half way between Cor Caroli (Heart of Charles) and Arcturus is M3, a bright globular cluster.

COMA BERENICES (BERENICE'S HAIR).

This constellation lies about midway between Leo and Bootes and to the north of Virgo. It is not conspicuous to the naked eye, but the scattered group of 5th and 6th magnitude stars are beautiful when examined with binoculars. The constellation is interesting in that it contains the northern pole of our galaxy and with the neighbouring constellation, Virgo, contains many groups of the extragalactic nebulae which seem to cluster about the pole of the Milky Way. As many as 300 of these nebulae have been observed in an area of the sky in this region equivalent to that covered by the moon. It was in this area that the first test photographs with the 200-inch telescope at Mt. Palomar were taken.

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Linseed Growing in Queensland.

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Summary.

1. Linseed is a winter annual crop grown only for seed in Queensland; it is a valuable alternative cash crop to wheat.

2. Wheat farm machinery is quite suitable for handling this crop.

3. A fertile, well drained soil is required for best results.

4. Linseed should be grown in rotation with other crops and linseed should never follow linseed directly on the same land.

5. Linseed is fairly cold tolerant. As adequate soil moisture is required during the growing season, it thrives best on well fallowed land.

6. Land preparation is similar to that for wheat, but with a slightly shallower seed-bed.

7. Seeding may be done through the wheat drill at 18 to 20 lb. per acre from mid-April to the end of June. Compaction of the soil by rolling following planting is very desirable. Early plantings appear to escape disease and insect infestation better than later plantings.

8. Clean seed is essential. As a protection, before planting it should be dusted with an organic mercury dust at the rate of 3 oz. per bushel.

9. Hormone weedicide sprays can be used if required to control certain weeds, but proper precautions must be observed.

10. Insect control by DDT dusting or spraying is frequently necessary when the plants are flowering freely and setting the crop.

Extent of the Industry.

Flax fibre and linseed are two products of the flax plant (*Linum usitatissimum*), of which there are two distinct types, one producing high yields of fine quality fibre in the stem and the other high yields of flax seed—the linseed of commerce. Linseed oil is obtained from the latter as well as the valuable by-product, linseed cake, which is a very useful protein-rich concentrate for feeding to stock.

Until a few years ago no linseed was grown on a commercial scale in Queensland, but since the first commercial crops, totalling about 112 acres, were harvested on the Darling Downs in 1947, the acreage of linseed grown for seed in Queensland has risen rapidly to over 25,000. While a remunerative price level is maintained, it seems certain that the linseed growing industry will continue to expand.

Average yields of linseed are not high, but at the current relative prices for wheat and linseed, the acreage monetary returns are sufficiently favourable to make the crop a strong competitor to wheat. Data on acreages and yields of linseed for Queensland for the seasons 1947-48 to 1950-51 inclusive, as supplied by the Queensland Government Statistician, are shown in the following table.

Season.	Area.	Production.	Yield per Acre.
	Acres.	Cwt.	Cwt.
1947–48	112	630	5·6
1948–49	4,193	18,760	4·5
1949–50	9,533	48,192	5·1
1950–51	14,986	71,217	4·8
1951–52	20,000*	100,000*	5·0*

* Estimate only. Approximately 38,000 acres were planted, but drought severely reduced the acreage harvested.

Linseed growing fits in very satisfactorily with the normal routine of wheat production, since the machinery required for growing and harvesting a wheat crop requires little modification for use with linseed. Thus to the wheat farmer on the Darling Downs it is a valuable additional cash crop and permits a slightly greater spread of the farm planting operations.

At present most of the acreage devoted to linseed growing in Queensland is on the Darling Downs, but commercial crops have been grown as far north as the Tropic of Capricorn. In general, however, it would appear that north of the Darling Downs oil content of the seed decreases and returns are less reliable. Any future expansion of the industry is most likely to occur on the Darling Downs and the districts bordering this area.

Plate 137.
Linseed Plants at the Flowering Stage.

General Description of the Linseed Plant.

Linseed (Plates 137–139) is a winter-growing annual plant reaching a height of 12 to 36 inches, depending on variety. It has a single primary stem, but a number of secondary branches may develop from the base of the stem; the number depends on the rate of seeding and space between plants as well as on varietal characteristics. The plant has a short tap root, but branch roots often extend as deeply as four feet. The foliage is comparatively sparse and for this reason weeds may be more troublesome than with wheat, which provides a better coverage of the ground.

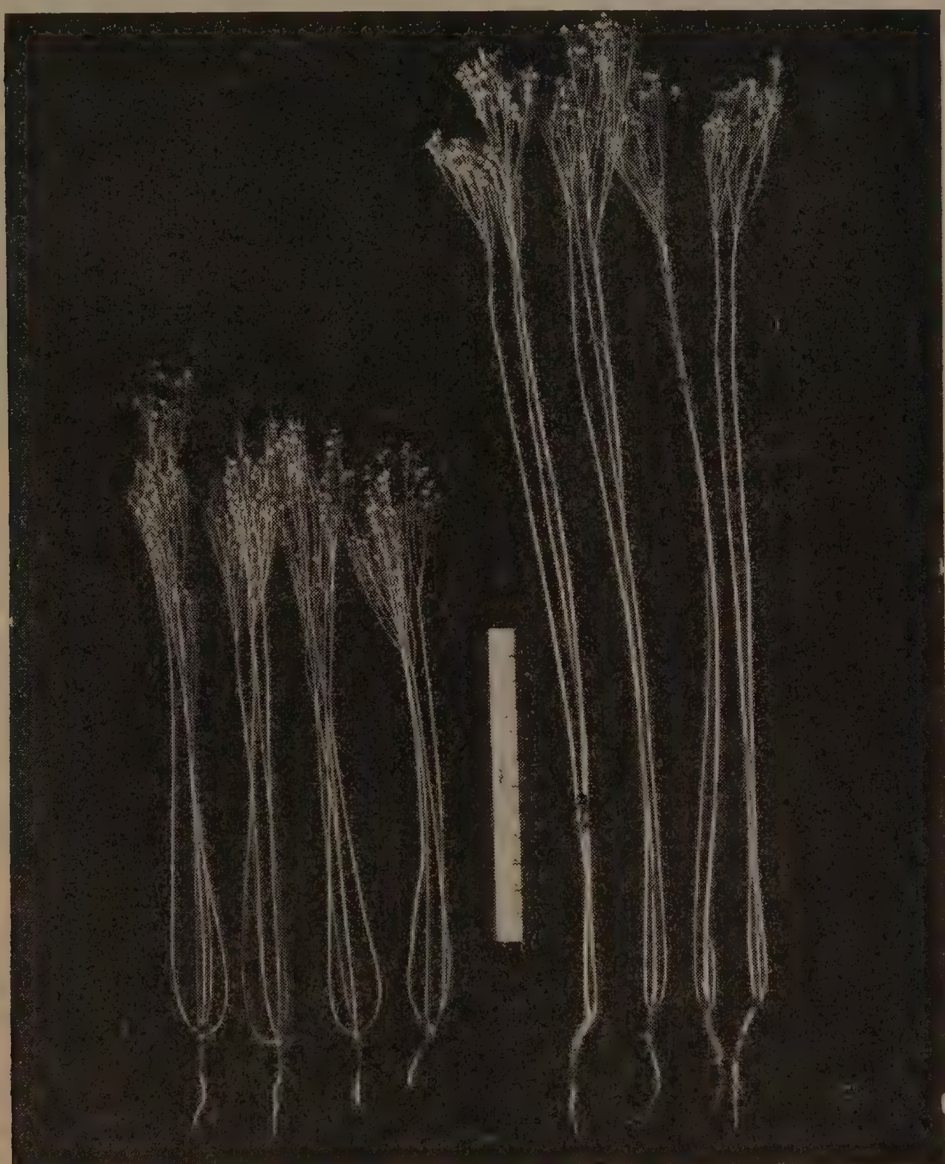

Plate 138.

Linseed Plants of Two Varieties, Showing Branching Habit. Left, linseed type; right, flax fibre type.

Flowers are generally self pollinated and open early in the morning. The petals may be white, pale pink or various shades of blue according to variety; they usually fall to the ground on the same day as the flower opens. The capsule or boll produced by the pollinated flower has five compartments and should produce 10 seeds; the full complement of seeds is only achieved, however, under optimum growing conditions.

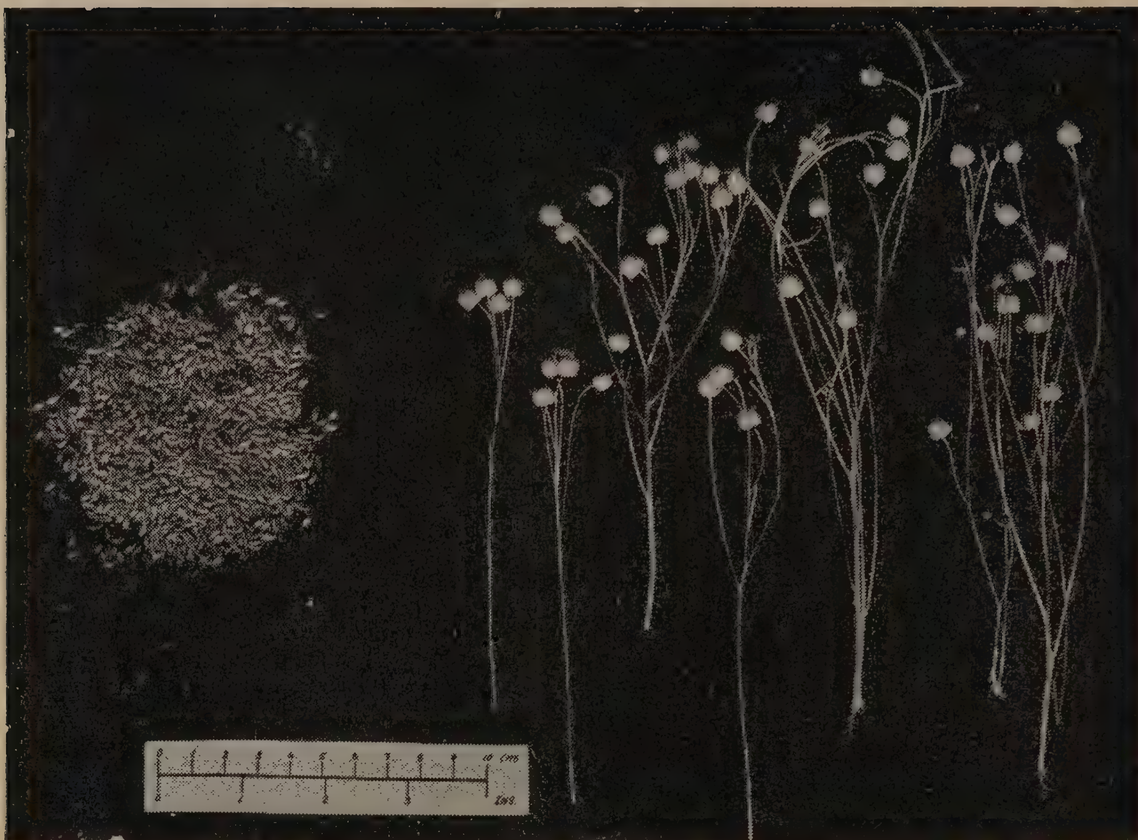

Plate 139.
Cleaned Linseed Seed and Seed Capsules or Bolls.

At harvest, the ripe bolls crush readily to release the seed. The seed is creamy to dark-tan in colour, flattish, shiny and about one-fifth of an inch long by one-tenth of an inch wide. Seed size, however, varies appreciably, depending on variety, growing conditions and latitude. For the same reasons, oil content may vary from 30 per cent. to over 44 per cent.

The variety Walsh, which is the only commercial variety in use in Queensland at present, has blue flowers and dark-tan seed and is a tall growing variety which may reach a height of 36 inches when well grown.

Climatic Requirements.

While essentially a temperate climate plant, linseed has demonstrated its ability to give payable yields of seed in the hotter, drier farming areas of Queensland, if an effective fallowing procedure is employed to ensure an adequate supply of subsoil moisture during the growing period. Crops can be grown to maturity on comparatively little seasonal rain if a good storage of subsoil moisture has been built up previously. However, for high yields, good rains when the main seed crop is maturing appear to be desirable. While the short five-month fallow following the preceding wheat crop is commonly used with satisfactory results, the long 17-month fallow often produces better and more payable crops.

Linseed is fairly tolerant of cold conditions. Frosts can cause considerable damage, though it is unusual for complete destruction of a crop to occur. Damage is usually restricted to isolated patches (Plate 140), or even to isolated plants. The seedling or cotyledonary stage is generally the stage most susceptible to frost injury. Older plants have shown varying response to frost. Considerable destruction of the primary stem may occur, resulting in many cases in an increase in the branching rate beyond that normal to the variety.

Frost damage after boll formation results in a darkening of the bolls, which are killed and usually develop a soft rot (Plate 141).

Plate 140.

Frost Damage in a Linseed Crop. The frosted patches stand out dark in the centre of the picture.

Plants past the seedling stage, but not more than five to six inches high, have shown considerable resistance to frost killing, though a fairly general weakening at the base of the stem on the easterly side, with lying over in that direction, has been noted. Plants damaged to this extent have also shown a tendency for stunted growth of the primary stem.

Definite evidence points to increased susceptibility to frost where plants are growing in a loose seed-bed, thus further demonstrating the value of rolling after seeding the crop.

Soil Requirements.

The crop requires a fertile, well-drained soil; hence most of the lighter and more loamy soils on the Darling Downs are quite suitable. Observations to date indicate that on the lighter and slightly less fertile soils linseed will thrive better and show more drought resistance than wheat.

Very heavy-textured, dark-brown soils on the Darling Downs have not proved satisfactory, and any areas where waterlogging is likely to occur should be avoided.

Bearing in mind the desirability of building up a subsoil moisture reserve to tide the crop over the winter season of erratic rainfall, it is generally recommended that soils which can be fallowed for this purpose should be used.

Plate 141.

Frost Damage to Linseed. The plants on the left are frosted, those on the right unfrosted.

In the Burnett districts, red volcanic loams of both the forest and scrub series have grown linseed crops with fair success (Plate 143). In these soils, however, it is not easy to build up a large subsoil moisture reserve, and for the most part, good crop results can only be expected when reasonably good winter rains are received.

Plate 142.

A Tall Linseed Crop with Good Yield Prospects in the Warwick District, Darling Downs.

Further north, in the Callide Valley, alluvial clay loams have been used for linseed. Subsoil moisture can be built up by fallowing in these soils. but the area is a marginal one for linseed production.

Because of the risk of disease infection from unrotted linseed stubble remaining in the soil, it is strongly recommended that linseed be not planted on land that has carried a crop of linseed in the previous season.

Land Preparation.

A first requirement for this crop is cultivated land at least one season out of pasture, since linseed generally gives poor returns on freshly broken land. A second essential is a relatively weed-free seed-bed, since the erect, non-smothering nature of the crop makes it a poor competitor with weeds.

The soil should be worked as for wheat, though if possible, the final depth of working should be shallower than for wheat, as deep planting of linseed is undesirable. As mentioned earlier, fallowing is essential for success with this crop, and greater success can normally be expected from the long 17-month fallow than from the short five-month fallow.

Plate 143.

A Linseed Crop in the South Burnett.

Varieties.

Walsh is the only variety grown commercially in Queensland. It is rust resistant but is susceptible to pasmo disease and wilt diseases. The oil content of seed grown on the Darling Downs varies around 40 per cent., but oil contents below 35 per cent. have been recorded from material from the Callide Valley.

It was fortunate that Walsh variety was available to initiate the linseed growing industry in Queensland and the reliability of this variety has been a major factor in the success achieved to date. The Department of Agriculture and Stock is carrying out trials (Plates 144 and 145) with other varieties and selections, and if and when material which is superior to Walsh is available, seed increases will be made for subsequent distribution to farmers.

Sowing.

Experiments conducted on the Darling Downs over the past few years have indicated that no worthwhile advantage can be gained by planting above 18 to 20 lb. of seed per acre.

Plantings may commence in mid-April and continue to the end of June. Earlier plantings may expose the crop to boll damage from late frosts, while very late plantings may expose the crop to greater damage from insects and disease and delay maturity to a point where the summer storm period may interfere with the harvest.

Plate 144.

Portion of a Linseed Variety Trial at Hermitage Regional Experiment Station, Darling Downs. Left, Rio; centre, Walsh; right, Morocco.

Plate 145.

Selections from the Variety Walsh Showing Differences in Plant Habit and Maturity.

The crop may be planted through an ordinary wheat drill, using every run and the gear setting as prescribed for planting wheat. It is desirable that the seed should be sown as shallow as possible in the prepared seed-bed, the normal planting depth being in the vicinity of two inches or less. As linseed is a slippery seed, it is as well to check over the wheat drill and to close up any possible holes through which seed might be lost.

The compaction of the seed-bed is of considerable importance, and the use of tyre or drum rollers, or cultipackers, after planting is recommended.

Fertilizers.

Several trials on the Darling Downs have given inconclusive results in regard to fertilizing these soils for linseed. However, observations made on some farms have indicated that upwards of 112 lb. of superphosphate per acre will give worthwhile results. It is suggested that farmers enquire regarding fertilizers from the nearest Adviser in Agriculture before making any applications.

Irrigation.

It is not expected that there will be any appreciable expansion of linseed growing under irrigation in this State. It is believed, however, that with spray irrigation, yields of 10 cwt. or more per acre could be obtained. One difficulty which has occurred in observational irrigated plots has been the amount of late growth occurring in the plants when the main crop of bolls has been ready for harvest. Seed recovery under these circumstances is greatly hindered. In irrigating linseed, therefore, care should be exercised to cease irrigation in sufficient time to allow the plants to mature and dry off for harvesting.

Chemical Weed Control.

Linseed plants do not compete successfully with prolific weed growth. To overcome this problem, the best and most effective method is the preparation of a weed-free seed-bed.

However, if it should happen that weeds threaten to become serious in a growing crop, it is possible to use hormone weedicides provided that the linseed is not sprayed when in a susceptible stage of growth and that the weeds to be treated are types which can be killed by hormone weedicides at rates of application of up to 1 lb. of the active ingredient per acre. The linseed plant is definitely liable to severe damage if hormone weedicides are applied in the seedling stage and at the flowering period. Applications can be made safely only after the plants reach four inches in height and before flowering commences.

Spraying is usually done by engine-operated spraying machines which are capable of treating many acres per day.

Harvesting.

The crop must be mature and dry before harvesting (Plate 146) so that the bolls may be readily broken to release the seed. At this stage the plants are brittle and brown in colour, with the seeds rattling audibly in the bolls. Unfortunately, on occasions late rains while the crop is maturing may promote secondary growth and further flowering. The problem then is to decide whether the early crop of bolls should be harvested before it falls off or whether the plants should be left

until the later crop also is mature. For the most part the farmer has to weigh up local conditions and use his own judgment. In general, however, it is preferable, if practicable, to wait until the late crop is mature and ready for harvesting; otherwise the harvested seed will contain green, immature seeds which lower quality and cause heating in the bags.

Plate 146.

Linseed Almost Ready for Harvesting.

The harvest period is the time when the necessity for preparing a weed free seed-bed is likely to be clearly apparent. As already explained, linseed does not compete very vigorously with weed growth. Weedy fields do not produce a good sample of linseed and dockages due to the presence of foreign matter are likely to be heavy.

The crop is normally harvested with a header-harvester direct (Plate 147). Occasionally crops may be cut and stooked to dry, and then fed into the header used as a stationary thresher.

Too close a setting of the drum in the header will result in a high proportion of crushed seed, which is most undesirable. Much loss of seed can also result from uncrushed bolls, so the drum setting must be carefully adjusted.

A modification of the header-harvester would permit a much wider drum setting and the production of a cleaner sample through correcting the overloading of the riddles with unbroken bolls and straw fragments.

Plate 147.
Harvesting Linseed with a Header-Harvester.

This modification consists of a pair of rollers, one steel and one rubber, between the elevator and the drum. The pressure from these rollers, through which the linseed plants pass, is sufficient to crack the bolls open. Consequently, only a light beating action is required from the drum, which may be set wide, in which position it will be able to pass greater quantities of straw. Further, the straw is less broken and hence the riddles will carry less trash, giving a cleaner sample with less loss of seed.

Diseases and Pests.

The linseed plant is liable to be infected by a number of diseases, including rust, pasmo and wilt. The use of disease-resistant varieties is highly desirable. Fortunately, the commercial variety Walsh is resistant to rust. The position is less favourable in the case of pasmo disease and wilt. The general recommendation for control is to adopt seed treatment as a routine measure, dusting the seed with an organic mercury compound at the rate of three ounces per bushel. Furthermore, it is recommended that linseed be sown only once in every three or four years on the same piece of land. On no account should linseed be grown on the same land for two years in succession.

Several insect pests attack linseed and in some of the past seasons damage by Heliothis caterpillar has seriously reduced yields. Early planting to ensure early flowering in the spring will reduce the likelihood of Heliothis attack. However, even in these cases the farmer should keep a close watch on Heliothis moth activity at flowering time so that chemical control measures, using applications of either DDT dust or spray through power equipment, can be taken if and when required.

Where equipment and materials are available, the routine application of DDT soon after flowering has much to commend it, particularly where crop development indicates a potentially heavy yield of linseed.

Detailed information on the control of diseases and pests may be obtained from local advisory officers or on application to the Science Branch, Department of Agriculture and Stock.

The Peach.

K. M. WARD, Senior Horticulturist.

THE peach (*Prunus persica*, family *Rosaceae*) has been known in the country of its origin, China, for at least 2,500 years. Very early in its history, it reached Persia from China. The Romans knew the fruit in the first century A.D. as the Persian apple, but its introduction to England dates back only to Anglo-Saxon times.

In Queensland, the peach is grown commercially mainly in the Stanthorpe area and also to a small extent in coastal districts near Brisbane. The crop has been produced for more than 50 years and is grown solely for the fresh fruit market; attention therefore has been focussed on dessert varieties. Production is about 160,000 half-bushel cases per year and almost the whole of the crop is sold within the State.

CHARACTERISTICS OF PEACH TREES.

Growth Cycle.

Dormant period—April to August.

Blossoming—Late August to late September.

Harvesting—Late November to mid-February.

Shoot growth—September to March.

Fruit bud initiation—January to March.

Leaf fall—March to April.

Fruiting Habits.

Peach trees bear fruit within two or three years of planting and reach the full bearing stage within eight years. The flower buds are borne in the axils of the leaves on lateral shoots or spurs produced during the previous season. Spurs may arise from latent buds on branches, especially where a shoot or branch has been cut back.

At the base of the typical one-year lateral (Plate 148, A) are vegetative buds (v), some of which will remain dormant during the next growing period. The central portion of the shoot is occupied by clusters of three evenly spaced buds (f), each cluster consisting of two rather robust flower buds with a small leaf bud between them. Towards the tip of the shoot are single leaf buds (l) and the shoot terminates in a leaf bud. The fruit develops, therefore, only from buds in the central portion of the shoot.

Plate 148.

Fruit-bearing Wood of the Peach. A Shoot growth at the end of 1st growing season. B. Shoot growth at end of 2nd growing season; it has borne a crop and is no longer fruitful. v, vegetative buds; f, flower buds; l, leaf buds; x, old fruit stalk; t, twig.

In the next growing season (Plate 148, B), the small buds at the base of the shoot remain inactive; at least one of the triple buds produces a fruit (x); the leaf buds above the basal portion produce leaves and sometimes small spurs (s). From the terminal bud, a small shoot or twig develops (t). The two-year-old wood is devoid of flower buds. The arrangement of buds on peach twigs follows this general pattern, but variations may occur according to the vigour of the shoot.

Flower bud differentiation in the peach takes place during the summer, and by January the first formed flower bud initials are usually present in the axils of the leaves on the lower-middle portion of the shoot. Other flower buds form later, further up the shoot.

VARIETIES.

Peach varieties grown in Queensland may be classified into temperate and sub-tropical groups. Within each group are clingstone and freestone types.

Varieties grown in the temperate climate of Stanthorpe highlands are of the greatest commercial importance, and these are:—

Freestone or semi-freestone.—Wiggins, Mayflower, Briggs' Red May, High's Early Canada, Zerbe, Elberta, J. H. Hale, Late Crawford, Nectarines.

Clingstone—Golden Queen, Pullar's Cling.

Sub-tropical varieties are China Flat, Bell's November, Beauty of Booroodabin, Watt's Early Champion and unnamed strains of dwarf peaches. These require less winter chilling than the temperate varieties.

Temperate Climate Varieties.

Wiggins.—A white-fleshed, medium-sized fruit with cream-coloured skin and a red blush. Though the fruit is often of good size, it tends to be small and lacking in colour as the tree ages. The tree blossoms in late August and the fruit is harvested mainly during the second half of December.

Mayflower.—An early variety, also known as *Sneed,* which requires a long winter chilling period and tends to shed its buds after a warm winter. The fruit is white-fleshed and of good quality. The tree blossoms from late August to early September and the fruit is harvested in late November.

Briggs' Red May.—A semi-freestone, medium-sized, rather highly coloured peach of good quality. The tree crops best on heavy soils and sheds fruit buds rather readily in light soils. Blossoming takes place in early September and the crop is harvested in early December.

High's Early Canada.—Closely resembles *Briggs' Red May* and ripens at the same time, but crops more consistently. Blossoms early September; harvested early December.

Zerbe.—A white-fleshed peach of medium size which ripens from December to early January. The tree crops well.

Elberta Strains.—Large, oval, yellow-fleshed, freestone peaches with much red colour in the skin, and suitable for drying, canning and dessert purposes. The trees are vigorous and bear consistently under a wide range of conditions. The trees blossom in late August and the crop is harvested in January. *Dripstone Elberta* matures a little earlier than *Blackburn Elberta.*

J. H. Hale.—A good quality, yellow-fleshed peach with a red blush; it arose as a chance seedling of *Elberta.* The blossom usually carries no viable pollen and cross-pollination is therefore essential. The fruit

does not set well after a warm winter. The trees are somewhat less vigorous and not as adaptable as *Elberta*. Blossoming takes place in early September and the fruit is harvested in late January.

Late Crawford.—A large and attractive fruit with yellow flesh and a deep red skin colour on the exposed surface; it is a freestone variety of high quality. The tree is very vigorous but relatively slow to reach the full-bearing stage. Cropping is not consistent, and as the tree ages, the fruit is frequently small and lacks both flavour and colour. The tree blossoms in early September and matures its fruit in early February.

Nectarines.—The nectarine is a smooth-skinned or fuzzless variety of peach; it is scarcely a commercial fruit at Stanthorpe. One of the best varieties is *Goldmine,* a large freestone nectarine with cream-coloured flesh and a red-flecked skin. The tree is vigorous and a consistent bearer, and ripens its fruit in January. *Early Rivers* is another mid-season variety of good quality.

Golden Queen and Pullar's Cling.—Large yellow-fleshed, clingstone peaches of excellent quality. Both are suitable for canning—*Golden Queen* more so than *Pullar's Cling*. The trees are vigorous and bear good crops which mature from late February to early March.

A number of other varieties are grown in the Stanthorpe area to spread the marketing season. Among these are *Beale,* a red-skinned, white-fleshed variety of semi-freestone type, which matures early in December, and *Lorimer,* a large, white-fleshed freestone peach, maturing in mid-February.

Sub-tropical Varieties.

Peaches grown commercially in coastal districts are very early varieties. They are grown almost wholly in the Pinkenba-Nudgee area near Brisbane.

China Flat.—One of the Peento or saucer peaches (*P. persica* var. *compressa*), characterised by having the fruit compressed at both ends and therefore flat-globe in shape. It is white-fleshed, of medium size and fair quality. The crop ripens from mid-November to late November. The tree is not very long-lived. Its buds require only slight winter chilling and the period of defoliation is short. The variety originated in southern China.

Bell's November.—A white-fleshed peach with an attractive red cheek; it ripens from mid-November to early December. The tree is very vigorous and usually carries a satisfactory crop.

Beauty of Booroodabin.—This variety has been developed from a local seedling. The fruit is a white-fleshed, freestone type, and though of medium size is one of the largest of the sub-tropical varieties. The tree is vigorous but not a heavy bearer.

Watt's Early Champion.—An attractive red-cheeked peach of medium size and good flavour. The crop ripens in November and the tree crops more consistently than Beauty of Booroodabin.

Dwarf Peaches.—A dwarfed strain of the peach is well adapted to sub-tropical conditions and is grown almost solely as a garden plant (Plate 149). Dwarfing is very marked and 20-year old trees seldom exceed a height of five feet. The trees are consistent bearers and crop at two to three years of age, producing a medium-sized, good quality fruit.

Plate 149.

Dwarf Peach Tree, Four Years Old, Partially Defoliated. Fully grown trees in this group are seldom more than 5 ft. to 6 ft. in height.

CLIMATIC REQUIREMENTS.

Though the dormant buds of the peach are less cold resistant than those of most other deciduous fruit trees, they are seldom seriously affected by winter frosts at Stanthorpe. Flower buds develop cold resistance earlier in the autumn than wood buds, but they rapidly lose this resistance when the rest period is broken, and are therefore endangered if an unseasonable warm spell of weather occurs in late winter or early spring. Open blossoms are no more tender than those of the apple, but are more susceptible to frost injury because they open earlier. Soon after setting, the young fruit can only survive light frosts of not more than about 2 deg. F. below freezing point. If the seed is killed by frost within 10 days after fertilization, the fruit usually drops.

Vigorous trees that hold their leaves well into the autumn are usually less affected by low temperatures following warm spells in winter than those which shed their leaves early. Such trees enter the rest period relatively late and may blossom after the risk of late frosts has passed.

The winter chilling requirements of the peach are greater than those of most other stone fruits. June and July are critical months. If the mean temperature for this period is above 49 deg. F., the trees are slow to come into leaf, and flowering also is delayed. At Stanthorpe, the mean temperature for this period is about 46.5 deg., but after a mild winter with mean June-July temperatures above 49 deg., crops may be reduced by bud shedding. The peach is more affected in this way than the apple, but less so than the apricot. Mayflower, Briggs' Red May and Hales Early are particularly susceptible to this trouble.

Some varieties require only slight winter chilling, notably the subtropical types grown in Queensland coastal districts. They blossom and fruit normally in areas where the mean temperature for June and July lies between 59 deg. and 60 deg.

Most peach varieties require high summer temperatures (a mean maximum of about 80 deg.) for the full development of flavour and colour in the fruit. High atmospheric humidity during the ripening period is injurious because of the development of brown rot in the fruit.

Moisture requirements of peach trees are generally satisfied by the Stanthorpe annual rainfall of 30 inches, 59 per cent. of which falls in the September-February period. In seasons of high rainfall the fruit is more easily bruised and breaks down more rapidly than under drier conditions. A soil moisture deficiency in midsummer can interfere with the formation of fruit buds for the next season's crop.

Plate 150.

Vigorous Young Peach Tree on Peach Rootstock.

SOIL REQUIREMENTS.

Though peaches are grown commercially on soils ranging from loams overlying friable clay to deep sandy soils, the preferred soil type is a deep sandy loam with a well-drained subsoil. In such a soil, the tree develops an extensive, rather deep root system and is healthy and productive. Peach roots are very intolerant of wet soil conditions and growth is strictly limited when subsoil aeration is bad. At Stanthorpe, the deep sandy types of soil are more suitable for the production of early fruit than the heavier soils.

PROPAGATION AND ROOTSTOCKS.

Peach trees are almost invariably grown on peach seedling rootstocks. Seeds of selected varieties, usually mid-season peaches, are sown during winter and the seedling trees are ready for budding from January to March in the following summer.

The peach rootstock is the most suitable for light-textured soils such as sands and sandy loams, and is the stock used in peach orchards at Stanthorpe (Plate 150). The Myrobalan plum stock is occasionally preferred on heavy, poorly drained soils. Apricot seedlings have also been used as rootstocks but are now discarded in favour of the peach.

TRAINING AND PRUNING.

Pruning is essential for the control of fruiting and tree growth in the peach. Since the tree bears fruit only on one-year-old wood, older wood is barren, and in the absence of appropriate pruning, the fruit is borne further and further out from the main branches.

Pruning the Young Trees.

In the early years of its life, the tree is pruned to form an open vase-shaped framework with about 12 strong main branches by the time it reaches the early bearing stage (Plate 151). Peach trees commonly bear fruit at an early age and a sturdy framework is therefore desirable. The trunk should be short, with strong and relatively short main branches forming a wide crotch angle with the trunk. Three to five main branches are retained at the end of the first year. These are pruned back heavily to about one-third of their length and produce shoots which may be used to form secondary branches in the following year. Surplus branches must be cut right out, together with any vigorous lateral shoots which might form main branches where they are not required.

Pruning the Bearing Tree.

As fruit is borne only on laterals and spurs produced during the previous season, ample new shoot growth is required each year. Annual pruning is therefore essential to maintain high yields of marketable fruit.

The fruiting lateral bears several leaf buds near the base and at the apex, and a number of fruit buds in the central portion. If such a lateral is pruned to half its length, the apical leaf buds are removed, together with some of the fruit buds near the centre. When growth recommences in spring, the fruit buds produce good-sized fruit and the basal leaf buds produce several shoots. At the next pruning, the wood which has fruited is removed completely, and two basal shoots are

Plate 151.

Well Shaped Three-year-old Peach Tree Carrying a Good Early Crop.

retained. Of these, the one furthest from the leader is left unpruned or just lightly cut back to bear fruit in the next growing season, while the other is pruned back to half its length to provide new shoot growth in the following year. Fruit-bearing wood is thus kept near the leader and all non-fruiting wood is eliminated. In the course of pruning, surplus laterals are removed and the fruit-bearing shoots are spaced evenly along the branch.

A fruiting arm or branchlet that has produced fruit for about four years can be replaced by a new shoot arising at or near its base. This practice of stimulating the production of new laterals by cutting back the old wood is common, and it can even force the growth of shoots from dormant buds on the main branches.

Terminal growth on leader branches is dealt with according to the vigour of the tree. In young, vigorous trees, the terminal shoots should be pruned back to laterals rather than to wood buds. The effect of this is to suppress rank terminal growth in the next growing season, and to force the development of fruiting laterals on the main branches. In less vigorous trees, the leaves are usually cut back severely in order to stimulate lateral and terminal growth.

Old healthy trees and trees which have been wrongly pruned can usually be forced to produce new shoots by cutting back the leaders. The cut should be made, however, just above a lateral shoot to avoid leaving a bare, dead stump. Cutting back the leaders to rejuvenate old trees should, in most cases, be a gradual process, the work being spread over several years.

Summer Treatment.

Summer pruning is usually necessary in young trees to remove surplus leader or lateral shoots, and to check the growth of over-vigorous terminal shoots. On bearing trees, light summer pruning is permissible when the thinning out of shoots is necessary to admit sunlight, and vegetative growth has to be controlled on shoots which have shed flower buds after the winter pruning.

RE-WORKING PEACH TREES.

Peach trees can be worked over from one variety to a more profitable one provided that they are healthy and vigorous. In both young and old trees, the main branches are cut back to within 18 inches of the trunk, and when new shoot growth appears, selected shoots are budded to the required variety. Bark grafting of the cut-back branches is also effective, and may be preferred, as this method produces new growth more rapidly than budding.

ORCHARD MANAGEMENT.

In peach orchards, cover cropping, soil moisture control, soil conservation and fertilizing are all important in the maintenance of production.

Soil Moisture.

Peach trees require good supplies of water, especially during the growing season, and cultural methods must ensure as far as possible that soil moisture does not become seriously depleted. Much of the soil moisture can be lost through the transpiration of cover crops and weeds, and in a normal season, therefore, it is necessary to practice clean cultivation during the spring and summer. Under Queensland conditions, cover crops must be turned in late in winter. If, however, the winter is abnormally wet, cover crops and weeds can be allowed to stand and assist in the disposal of excess water; they may then be turned in as soon as soil moisture conditions return to normal.

If, on the other hand, peach trees are planted on soil which has an impervious layer within 18 to 24 inches of the surface, tile drainage may be necessary. In well-drained soils, the intake of water, either from rain or irrigation, can be improved by planting the trees on the contour and by constructing gently graded "contour" drains.

Cover Cropping.

A green manure should be grown each year to maintain soil fertility. The most suitable crop for the Stanthorpe district is New Zealand blue lupin (Plate 152), and inoculated seed should be sown, preferably in February. On land in which lupins have not previously been grown successfully, the seed is sown at a rate of one bushel per acre, but as soil fertility improves, this rate of seeding can be reduced. When sowing the crop for the first time, it will usually be necessary to apply 2 cwt. per

acre of a 4 : 15 : 2 fertilizer mixture to ensure its establishment. The fertilizer also increases the amount of green matter produced by the crop. Subsequent crops may not require fertilizing.

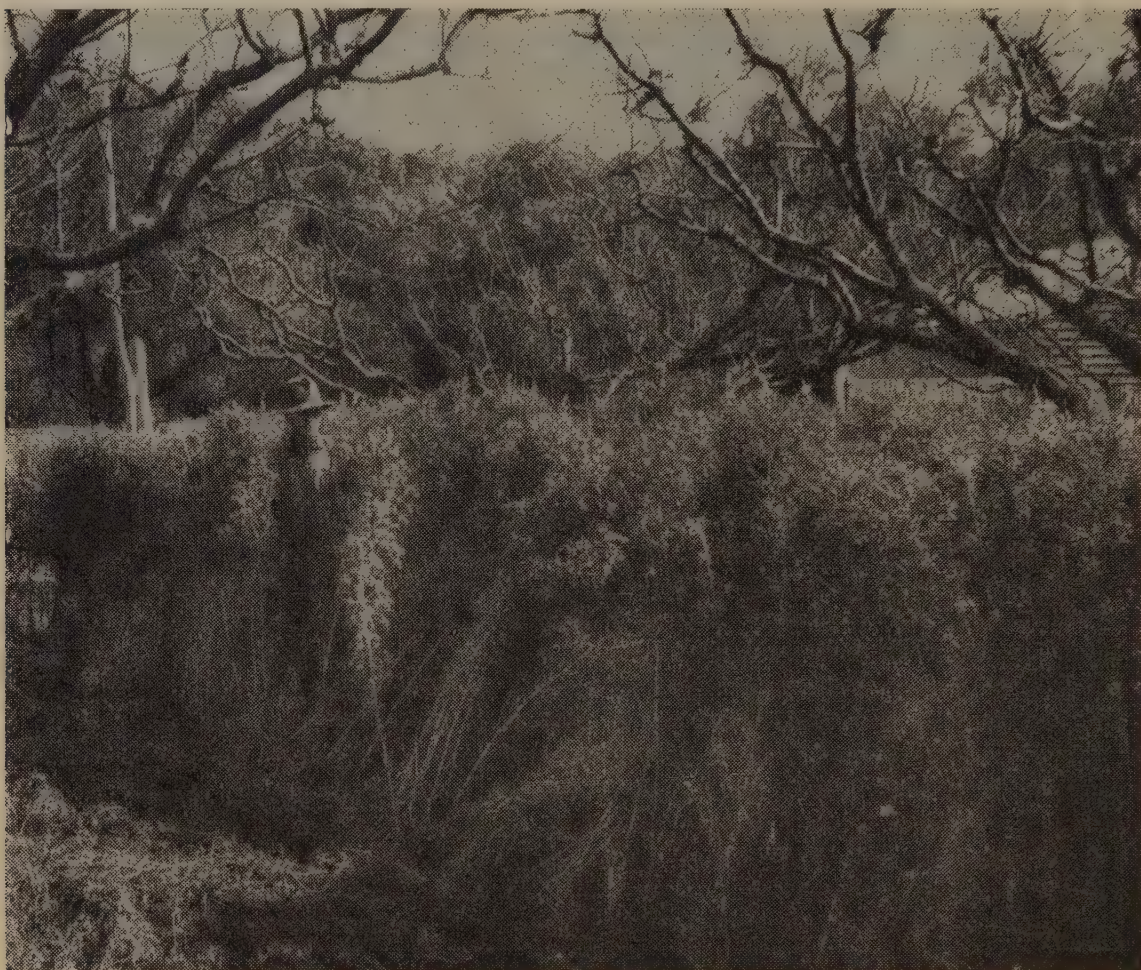

Plate 152.

New Zealand Blue Lupin in a Stanthorpe Peach Orchard.

Lupins sown in February make rapid growth in the autumn and reach the peak of their growth by the end of July or early August. Since the dormant period in peach trees ends in late August, the green manure crop should be turned in or disced and left on the surface by the beginning of that month. A cereal crop such as Black Winter rye may be grown occasionally in rotation with lupins.

Fertilizing.

Peach trees have a higher nitrogen requirement than most other deciduous fruit trees and they usually respond to nitrogen whether it is applied in the form of a green manure crop or as an artificial fertilizer. The need for nitrogen is shown by a marked falling off in shoot growth and by yellowing and stunting of the leaves. If the trees are making ample growth, a nitrogenous fertilizer may not be necessary every year, especially if a leguminous cover crop is planted annually. Excessive nitrogen adversely affects flavour and keeping quality of the fruit and will even delay ripening by a week or more.

If the trees require it, a high nitrogen fertilizer, such as 8 : 10.5 : 5 mixture, can be applied when the cover crop is turned in. The rate of application will vary with the condition of the trees, but in a light-textured soil, a dressing of 4 lb. of this mixture per bearing tree, applied

in late July or early August, and again in November, should be adequate. Where cover cropping is regularly practised, little fertilizing may be necessary.

Peach trees do not appear to be so susceptible to zinc, copper and boron deficiencies as apple trees, and corrective treatments have not been required in Stanthorpe orchards.

FRUIT THINNING.

In the course of pruning, the fruiting wood is thinned out very considerably and this helps to increase fruit size. However, peach trees tend to set heavy crops, and it is also necessary to thin the fruit by hand, especially in years which are very favourable for setting. It is advantageous to begin thinning the fruit soon after the last natural shedding has taken place and to work over the trees at least twice during the season. If the final thinning is done within a few weeks of harvesting, fruit size is markedly improved.

The first thinning is done by removing small, immature or mis-shapen fruits from the trees and at the same time reducing the clusters of perfectly formed peaches considerably so that the fruit is well spaced. Heavy thinning may leave the fruits six to eight inches apart, and light thinning at half this distance. The amount of thinning required depends on the vigour of the tree and is, in practice, determined by observations on tree behaviour (Plate 153).

Plate 153.

A Well Spaced Crop of Pullar's Cling Peaches.

Peaches for the fresh fruit market should be medium to large in size, and the amount of thinning is often determined by market requirements and seasonal conditions. It pays to thin more severely in a year of generally heavy setting.

FRUIT DEVELOPMENT AND HARVESTING.

The peach, like other stone fruits, passes through three distinct stages of development. In the first of these, cell multiplication causes a rapid increase in the size of the fruit but the stone is soft, watery and small; during the second stage, the seed grows rapidly but growth of the flesh slows down very considerably; in the third stage, increase in fruit size is again rapid and takes place by the enlargement of the individual cells. At this final "swell", much of the moisture and solids contained in the flesh at maturity is transported into the fruit.

The fruit has reached maturity when the green colour commences to fade and is replaced by a yellowish tinge in the case of yellow-fleshed peaches, and by a creamy tinge in the case of white-fleshed varieties. For near markets, the fruit may be picked after the greeen colour has faded, but for more distant markets, some green colour should be present. On vigorous trees carrying much foliage which shades the fruit, the green colour is rather persistent and the fruit is harvested with less colour than that on trees carrying less foliage. The firmness of the fruit also gives an indication of maturity.

During the last few days of ripening, peaches increase rapidly in size and improve in appearance. It is not always possible to wait for this final change because the crop ripens rapidly and harvesting must generally begin just as soon as a proportion of the crop is mature enough for market. Nevertheless, fruit must be sufficiently mature to ripen properly, to develop full flavour, and be firm enough to reach the market in good condition.

Baskets or buckets are used for gathering the fruit. A popular type of bucket can be made from a kerosene tin opened on the side and fitted with either a strap to hang on the shoulder or a handle. The fruit must be picked and placed gently in the container without breaking the skin or bruising the flesh; rough handling during harvesting and packing must be avoided. From the picking basket, the fruit is transferred to orchard boxes, which should always be placed in the shade of the trees, and transported to the packing shed as soon as possible.

Peaches must be cooled before being packed, and this can be done by placing them in shade in shallow boxes which have been only partly filled to allow free circulation of air. Fruit packed when warm ripens more rapidly than that which is allowed to cool before it is packed, and wastage in transit to market is higher. Pre-cooling is particularly important in fruit packed for a distant market. As far as practicable, peaches should not be picked when they are wet nor immediately after heavy rain when the soil is saturated.

Peaches for the fresh fruit market are packed mainly in half-bushel dump cases which hold about 25 lb. of fruit. The half-bushel is preferred to the bushel case because soft fruit should not be subjected to much pressure from overlying layers. Trays containing 12 to 14 lb. of fruit are occasionally used for marketing.

Ear Notching of Pigs.

Prepared by Officers of the Pig Branch.

BEFORE a litter is weaned, the young pigs should be given a permanent identification mark. Tattooing, tagging, and ear notching are common methods of identification, but of these the last-mentioned is undoubtedly the best and as nearly permanent as possible. Notching has the advantage over tattooing in that it can be used on all breeds of pigs and, if neatly done, remains legible regardless of the pig's age. A pig's number also can be observed in the paddock without the necessity of yarding the animal and perhaps washing its ear.

Metal tags are not satisfactory as they are often lost through pigs fighting or rubbing their ears against fences or other objects. With this method, also, the pig has to be yarded and the tags cleaned before the number can be read.

Until recently tattooing was the only method of ear marking officially recognised by the Australian Pig Society. Large White, Middle White and Tamworth pigs are still required by the Society to be tattooed for official identification.

On and after 1st May, 1952, it will become compulsory for all members of the Australian Pig Society to ear notch all coloured pigs other than Tamworths. The system adopted for this purpose is the one explained and illustrated in this leaflet. It has been recommended and used by this Department over a number of years.

It is not claimed that ear notching is the perfect system of identification, for it is realised that pigs may occasionally tear their ears through fighting, thus marring the notches; their ears also may be disfigured by excessively deep and careless notching.

However, these risks may be reduced to a minimum if the following points are observed.

1. No marks should be placed from the middle to the base of the upper edge of the ear. The cartilage in this position is quite thick and it is necessary to cut deeply into it to ensure that the notches will not grow out as the pigs age. As a result there is always a danger of the ear drooping over in an unsightly manner—a very objectionable feature, especially in show stock.

2. The value or number allotted to positions near the point of the ear should be so designed that it is not necessary to take out more than one notch in this part of the ear for any number; otherwise the tip of the ear may droop.

3. Round punch holes should not be used near the tip of the ear. In this position they are prone to cause tearing.

4. Pieces removed from the ear should vary according to the size of the pig.

The ear notching system illustrated in Plate 154 has been designed to comply with the above limitations as far as possible and is one example of many systems in which notches in particular positions of the ears represent numbers, thus enabling each pig or each litter to carry a different number. A brief description of this system, which employs both ears for notching, is as follows:—

All unit numbers are placed on the right ear and the tens in the left or near ear. Confusion between the two may be avoided by remembering that the words unit and right each contain the letter "i" and the words ten and left the letter "e."

It will be noted that numbers 1, 2, 4 and 7 are recorded by a single notch, the value being determined by the relative position on the ear. The numbers 3, 5, 6, 8, and 9 represent a combination of the previous positions (for example, 2 and 1 to make 3; 4 and 1 to make 5; 4 and 2 to make 6, and so on). For these numbers it is therefore necessary to make two notches.

The tens are represented by notches in the left ear, the 10, 20, 40 and 70 positions corresponding to the 1, 2, 4 and 7 positions respectively in the right ear.

Any number up to 99 may thus be made by a combination of the above figures. If it is necessary to number beyond 99, round punch holes could be used as shown in the diagram, but in the average herd, where all pigs in the litter are given the same number, it is usually unnecessary to go beyond 99. By adopting the 1, 2, 4, 7 combination the number of cuts in the ear is reduced to a minimum.

As the position of the notch on the ear determines the value, it is important that positions 1 and 10 be kept well towards the bottom of the ear and positions 4 and 40 well towards the tip of the ear to prevent confusion with the positions 2 and 20 in the middle of the ear. Likewise these latter positions should be as nearly as possible exactly midway along the ear, otherwise confusion may occur as between position 2 and either position 1 or 4, and as between position 20 and either position 10 or 40.

RIGHT EAR—UNITS. LEFT EAR—UNITS.

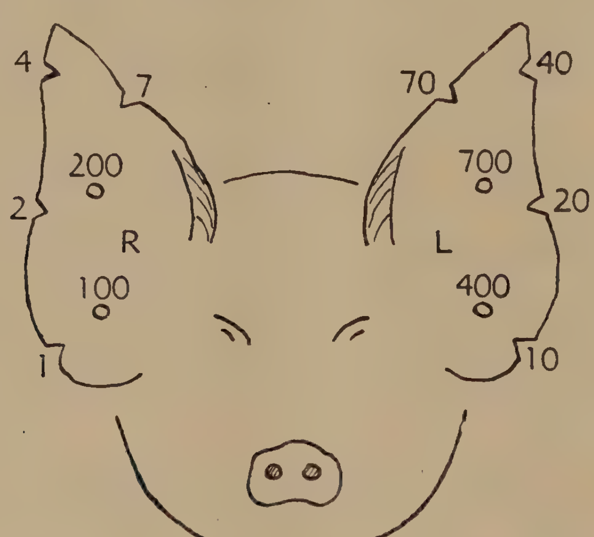

Plate 154.

The Key or Guide to the Ear-Marking System.

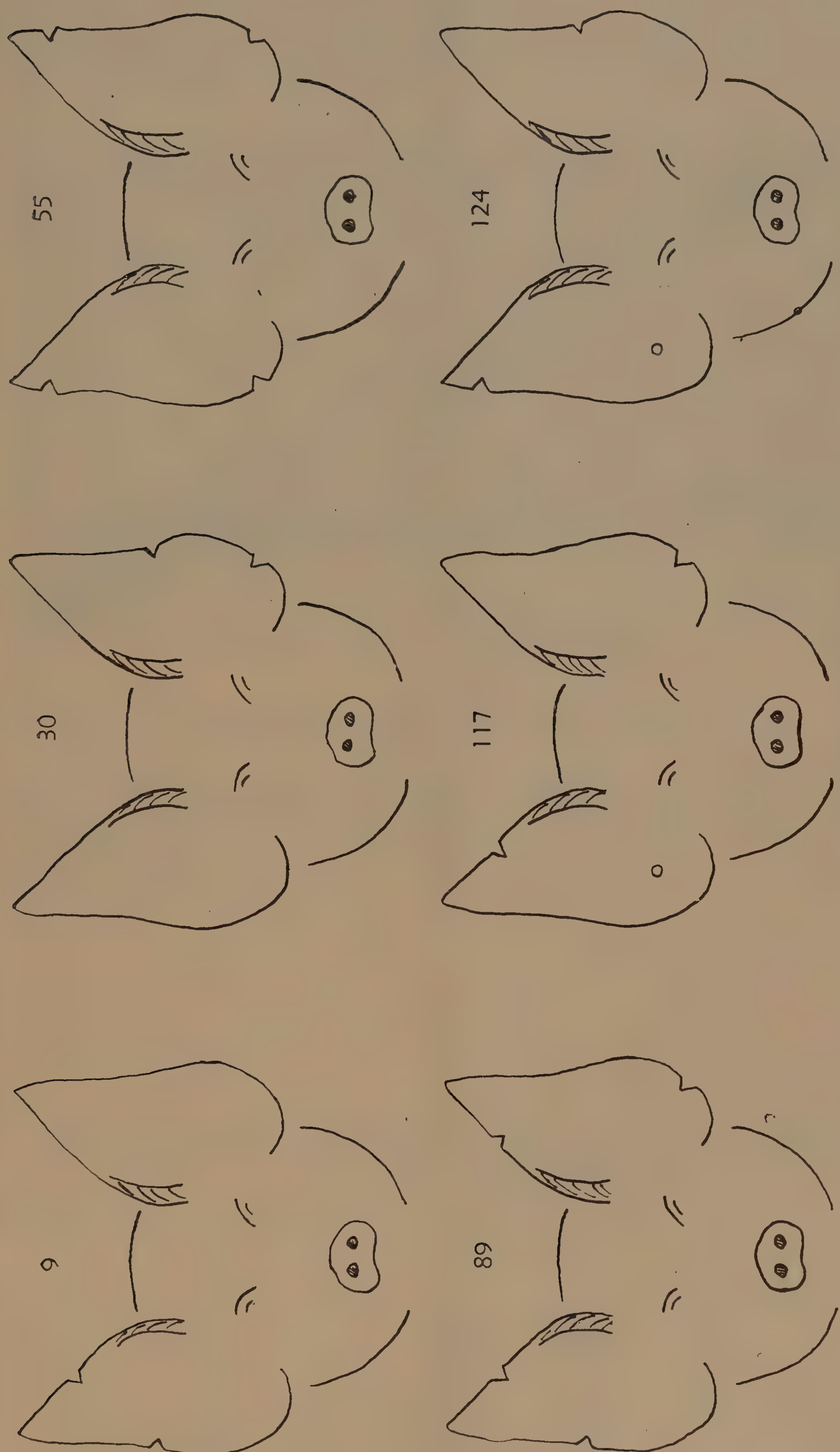

Plate 155.

Diagrams Showing How Various Numbers would be Marked.

SOW'S BREEDING RECORD.

Name of Sow : " Sunnybrook Pearl XVI."

Breed : Large White.

Date of Farrowing : 3-7-48.

Earmark No. 65.

Sire : " Sunnybrook Major II." Earmark : 32

Dam : " Sunnybrook Gem V." Earmark : 12

Litter Farrowed—	Sire of Litter.	Number in Litter.		Died at Birth.		Date of Deaths before Weaning.		Earmark and Date Weaned.	Disposal of Litter. Date of Deaths after Weaning.		Sold to Market. Date.	Number.		Average Weight.	Price.	Gross Return.	Remarks.
		Boars.	Sows.	Boars.	Sows.	Boars.	Sows.		Boars.	Sows.		Boars.	Sows.	lb.	s. d.	£ s. d.	
2-9-50	Sunnybrook Major	7	5	1	1	..	1 3-10-50	65 29-10-50	..	..	28-3-51	5	2	140	2 0	98 0 0	1 pig born dead
								Boars. Sows.	..	..	10-4-51	1	1	136	2 0	27 4 0	1 pig overlain
								6 3									1 death — pneumonia
																	9 baconers marketed
																125 4 0	

Pliers with a ∧ shaped cutting piece are recommended for ear marking, as notches of various sizes—according to the age of the pig—can be made simply by pushing the pliers varying distances on the ear. Small pigs up to weaner age should have only a comparatively small piece removed from the ear.

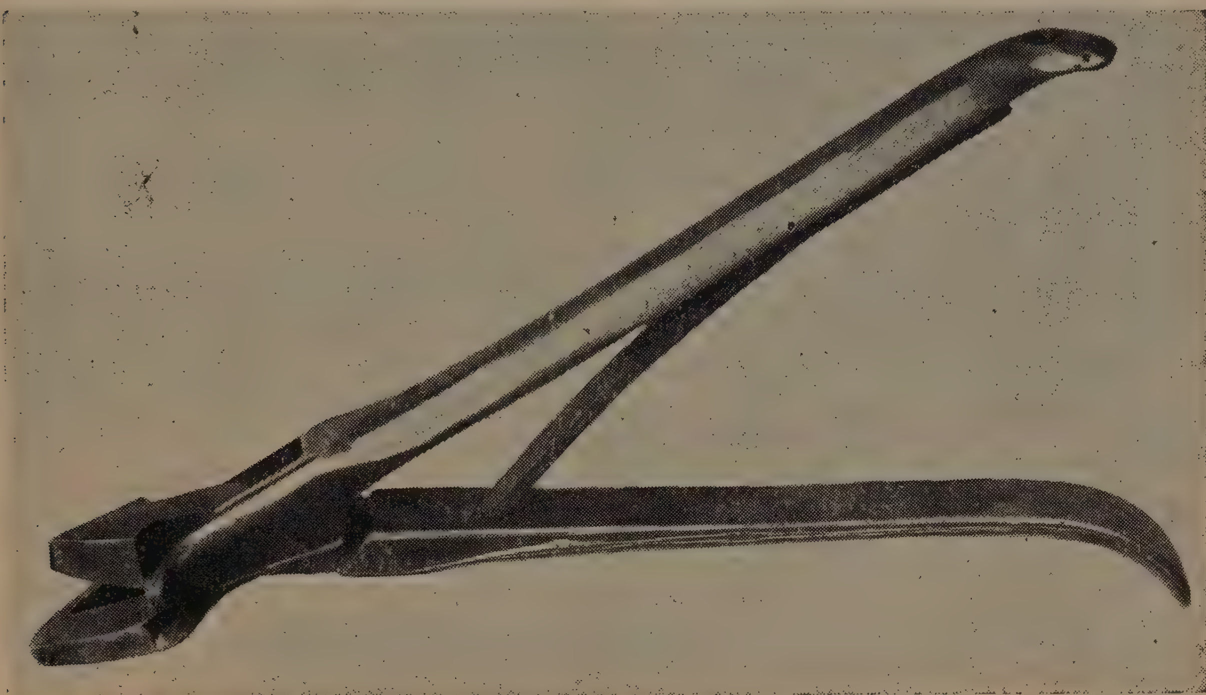

Plate 156.
Ear-Marking Pliers with a ∧ Shaped Cutting Piece.

Careful recording of the ear mark allotted to each animal or each litter of pigs (see specimen breeding record) is just as important as the marking itself, for one's memory should not be relied upon in these matters. Identification of pigs in this way is also of value in recording pedigree and performance.

CAPACITY OF CIRCULAR FODDER SILOS (IN TONS).

Inside Height (ft.).	Inside Diameter of Silo. 10 ft.	11 ft.	12 ft.	13 ft.	14 ft.	15 ft.
20	28	34	40	47	55	63
21	29	36	42	50	58	66
22	31	38	45	53	61	71
23	33	40	47	55	64	74
24	35	42	50	59	68	78
25	36	44	52	61	71	82
26	38	46	56	65	76	87
27	40	48	58	68	78	90
28	42	51	61	71	83	95
29	44	53	63	74	86	99
30	46	56	67	78	91	104

Brucellosis Testing of Swine.

The Department of Agriculture and Stock is operating a scheme whereby pig herds are tested at intervals for the occurrence of swine brucellosis (contagious abortion).

A herd listed by the Department as "brucellosis tested" is one in which all such animals as may be determined by the Director of the Department's Division of Animal Industry have been subjected to two successive tests for brucellosis, at intervals determined by him, without any positive reactors being found.

In order for a herd to be retained on the list of Tested Herds, a semi-annual or annual re-test of the herd, as determined by the Director, is required. If at a re-test any animal gives a positive reaction to the test the herd is removed from the list; it is not listed again until subsequent tests, as determined by the Director, have been carried out.

Full particulars of the Brucellosis Testing of Swine and application forms may be obtained from the Under Secretary, Department of Agriculture and Stock, William Street, Brisbane.

TESTED HERDS.
(AS AT 16th MAY, 1952.)

Breed.	Owner's Name and Address of Stud.
Berkshire	S. S. Ashton, " Scotia " Stud, Pittsworth
	J. J. Bailey, " Lucydale " Stud, East Greenmount
	S. Cochrane, " Stanroy " Stud, Felton
	Garrawin Stud Farm Pty. Ltd., 657 Sandgate road, Clayfield
	G. Handley, " Handleigh " Stud, Murphy's Creek
	J. L. Handley, " Meadow Vale " Stud, Lockyer
	R. G. Koplick, " Melan Terez " Stud, Rochedale
	H. V. Littleton, " Wongalea " Stud, Crow's Nest
	O'Brien and Hickey, "Kildurham" Stud, Jandowae East
	E. Pukallus, " Plainby " Stud, Crow's Nest
	G. C. Traves, " Wynwood " Stud, Oakey
	E. Tumbridge, "Bidwell " Stud, Oakey
	Westbrook Farm Home for Boys, Westbrook
	H. W. Wyatte, Rocky Creek, Yarraman
	H. M. State Farm, " Palen Creek," Palen Creek
	A. R. Ludwig and Sons, " Cryna " Stud, Beaudesert
	H. H. Sellars, " Tabooba " Stud, Beaudesert
	F. Thomas, " Rosevale " Stud, Beaudesert
	Bowkett and Meacle, " Myola Vale " Stud Piggery, Burra Burri, Jandowae
	D. T. Law, Trouts Road, Aspley
	R. J. McCullough," Maxholm " Berkshire Stud, Gatton
	C. F. W. and B. A. Schellback, " Redvilla " Stud, Kingaroy
	R. H. Crawley, " Rockthorpe " Stud, *via* Pittsworth
	F. R. J. Cook, " Alstonvilla," Wolvi, via Gympie
	D. E. and E. C. Apelt, "Thelmur," Oakey
	Mrs. I. M. James, "Kenmore" Stud, Cambooya
	H. L. Stark, "Florida," Kalbar
Large White	H. J. Franke and Sons, " Delvue " Stud, Cawdor
	Garrawin Stud Farm Pty. Ltd., 657 Sandgate road, Clayfiel
	F. L. Hayward, " Curyo," Jandowae
	J. A. Heading, " Highfields," Murgon
	K. B. Jones, " Cefn " Stud, Pilton
	R. G. Koplick, "Melan Terez " Stud, Rochedale
	R. Postle, " Yaralla " Stud. Pittsworth
	E. C. Smith, "Smithfield" Stud, Coomera
	E. J. Bell, " Dorne " Stud, Chinchilla
	A. G, Fry, "Birubi" Stud, Dalby
	N. E. Myers, Halpine Plantation, Kallangur

TESTED HERDS—continued.

Breed.	Owner's Name and Address of Stud.
Large White—*continued*	L. C. Lobegeiger, "Bremer Valley" Stud, Moorang, *via* Rosewood
	J. H. G. Blakeney, "Talgai" Stud, Clifton
	V. P. McGoldrick, "Fairymeadow" Stud, Cooroy
	N. Woltmann and Sons, Wooroolin
	R. S. Powell, Kybong, via Gympie
	E. B. Horne, "Kalringal," Wooroolin
	S. T. Fowler, "Kenstan" Stud, Pittsworth
	J. A. and J. McNicol, "Camden," Canning Vale, Warwick
Tamworth	S. Kanowski, "Miecho" Stud, Pinelands
	N. R. Potter, "Actonvale" Stud, Wellcamp
	D. F. L. Skerman, "Waverley" Stud, Kaimkillenbun
	A. C. Fletcher, "Myola" Stud, Jimbour
	L. C. Lobegeiger, "Bremer Valley" Stud, Moorang, *via* Rosewood
	Salvation Army Home for Boys, Riverview
	F. Thomas, "Rosevale" Stud, Beaudesert
	A. J. Surman, Noble Road, Goodna
	P. V. McKewin, "Wattleglen" Stud, Goombungee
	Department of Agriculture and Stock, Regional Experiment Station, Kairi
	P. V. Campbell, Lawn Hill, Lamington
	E. C. Phillips, "Sunny View," M.S. 90, Kingaroy
	T. A. Stephen, "Withcott," Helidon
	W. F. Kajewski, "Glenroy" Stud, Glencoe
Wessex Saddleback ..	W. S. Douglas, "Greylight" Stud, Goombungee
	K. Day and P. Hunting, "Kazan" Stud, Goodna
	E. Sirrett, "Iona Vale" Stud, Kuraby
	C. R. Smith, "Belton Park" Stud, Nara
	H. H. Sellars, "Tabooba" Stud, Beaudesert
	H. Thomas, "Eurara" Stud, Beaudesert
	D. T. Law, Trouts Road, Aspley
	G. J. Wilson, "Glenbella" Stud, Silverleigh
	G. J. Cooper, "Cedar Glen," Yarraman
	J. B. Dunlop, Acacia Rd., Kuraby

HAVE YOUR SEEDS TESTED FREE

The Department of Agriculture and Stock examines FREE OF CHARGE samples representing seed purchased by farmers for their own sowing.

The sample submitted should be representative of the bulk and a covering letter should be sent advising despatch of the sample.

MARK YOUR SAMPLE

Sample of .... seed
Drawn from .... bags
Representing a total of ....
Purchased from ....
Name and Address of Sender
Date....................

SIZE OF SAMPLE

Barley -	8 oz.	Oats -	8 oz.
Beans -	8 oz.	Peas -	8 oz.
Grasses	2 oz.	Sorghum	4 oz.
Lucerne	4 oz.	Sudan -	4 oz.
Millets	4 oz.	Wheat -	8 oz.

Vegetable Seeds - ½ oz.

SEND YOUR SAMPLE TO—**STANDARDS OFFICER, DEPARTMENT OF AGRICULTURE AND STOCK, BRISBANE.**

TUBERCULOSIS-FREE CATTLE HERDS.
(AS AT 16th MAY, 1952.)

Breed.	Owner's Name and Address of Stud.
Aberdeen Angus ..	The Scottish Australian Company Ltd., Texas Station, Texas F. H. Hutton, "Bingegang," Dingo
A.I.S.	F. B. Sullivan, "Fermanagh," Pittsworth D. Sullivan, "Bantry" Stud, Rossvale, *via* Pittsworth W. Henschell, "Yarranvale," Yarranlea Con. O'Sullivan, "Navillus Stud," Greenmount H. V. Littleton, "Wongalea Stud," Hillview, Crow's Nest J. Phillips and Sons, "Sunny View," Kingaroy Sullivan Bros., "Valera" Stud, Pittsworth Reushle Bros., "Reubydale" Stud, Ravensbourne H. F. Marquardt, "Chelmsford" Stud, Wondai W. G. Marquardt, "Springlands," Wondai A. C. and C. R. Marquardt, "Cedar Valley," Wondai A. H. Sokoll, "Sunny Crest," Wondai W. and A. G. Scott, "Welena," A.I.S. Stud, Blackbutt G. Sperling, "Kooravale" Stud, Kooralgin, via Cooyar
Ayrshire	L. Holmes, "Benbecula," Yarranlea J. N. Scott, "Auchen Eden," Camp Mountain "St. Christopher's and Iona" Studs, Brookfield Road, Brisbane E. Mathie and Son, "Ainslie" Ayrshire Stud, Maleny
Friesian	C. H. Naumann, "Yarrabine Stud," Yarraman J. F. Dudley, "Pasadena," Maleny
Guernsey	C. D. Holmes, "Springview," Yarraman
Jersey	W. E. O. Meier, "Kingsford Stud," Rosevale, *via* Rosewood J. S. McCarthy, "Glen Erin Jersey Stud," Greenmount J. F. Lau, "Rosallen Jersey Stud," Goombungee G. Harley, Hopewell, Childers Toowoomba Mental Hospital, Willowburn Farm Home for Boys, Westbrook F. J. Cox and Sons, "Rosel" Stud, Crawford, Kingaroy Line R. J. Browne, Hill 60, Yangan P. J. L. Bygrave, "The Craigan Farm," Aspley A. Vorrall and Sons, "Coleburn Stud," Walloon R. J. Crawford, "Inverlaw Jersey Stud," Inverlaw, Kingaroy p. H. F. Gregory, "Carlton," Rosevale, via Rosewood E. A. Matthews, "Yarradale," Yarraman A. L. Semgreen, "Tecoma," Coolabunia G. & V. Beattie, "Beauvern," Antigua, Maryborough L. E. Meier, "Ardath" Stud, Boonah A. M. and L. J. Noone, "Winbirra" Stud, Mt. Esk Pocket, Esk W. S. Conochie and Sons, "Brookland" Stud, Sherwood Road, Sherwood

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Vital Statistics and the Queensland Sheep Industry—Part 3.

G. R. MOULE, Director of Sheep Husbandry.

IN previous articles in this series, an outline was given of the uses to which vital statistics pertaining to the sheep industry could be put. The purpose of this article is to deal in greater detail with their use in relation to the breeding of stud sheep.

Stud masters collect more detailed figures than flock men and the majority of these are summarised in the Australian Stud Merino Flock Register, which is published each year. A study of the figures which these volumes contain throws interesting light upon various aspects of the Merino stud sheep industry in Queensland, and gives some indication of the progress which might be expected from the methods of sheep breeding practised at present. An analysis of these figures was undertaken recently. Some of the information which was extracted is contained in this article.

The Growth of the Merino Stud Sheep Industry.

The first Merino flocks, and for a time the only ones in Queensland, were owned by the Government. In 1839 there were 4,000 sheep and in 1843 there were 12,000. In 1842, however, the Moreton Bay district, as it was then known, was thrown open to settlers and the Government disposed of its stock to them. Some settlers brought sheep with them and in 1844 there were 184,651 sheep in Queensland; of these, 110,231 were on the Darling Downs. By 1849 sheep numbers had increased to 1,077,938.

The first Merino sheep stud in Queensland was Glengallan, founded by Mr. F. Bracker, of the North British Australian Company, with ewes from Brindley Park. The Eaton Vale stud was founded in 1850 and East Talgai in 1867. The latter was probably the greatest stud in Queensland's early history. It sold 2,000 rams a year and its first consignment of four rams to Sydney averaged £268 2s. 6d. each. A ram known as "Jack Dowling" was bought for use in the Rhodes and Pisa Studs. E. W. Cox states "This was the best sire ever bred in East Talgai stud: his progeny were wonderfully successful."

The Jimbour stud was founded in 1864 and Canning Downs in 1867. Bon Accord followed in 1870 and Pikedale in 1871, but the latter remained closed and no animals were sold until it was dispersed. Wool from Pikedale won a gold medal at the Paris Exhibition in 1878. This, incidentally, was the only gold medal won by Queensland at the Exhibition.

None of these studs have continued, but others founded at about the same time are still firmly established. However, towards the end of the last century there was a rapid increase in the number of sheep in Queensland and by 1892 the State's sheep population reached 20 millions. There was not a comparable expansion in the stud industry and New South Wales became the principal State supplying rams to Queensland, although some came from South Australia.

During the first quarter of this century, special leases were granted to people who wished to establish Merino studs. The holders of stud leases were required to carry certain numbers of ewes and to sell a minimum number of rams, the number depending upon the area of their holding. The granting of these leases did a good deal to encourage the establishment of studs in this State and at the present time 18 leases of this type are held. In addition, stud conditions pertain to five grazing homesteads and farms.

Greater interest has also been taken in the breeding of stud sheep by individuals holding smaller properties, and since 1935 the membership of the Queensland Merino Stud Sheepbreeders' Association has increased from 45 to the present-day figure of 64.

Some indication of the time during which the stud sheep industry has been established in Queensland, and of its strength, is given by Tables 1 and 2, which show the age and size of the registered stud flocks and the turn-off of sale rams.

TABLE 1.

SHOWING THE NUMBER OF REGISTERED STUD FLOCKS, THEIR AGES AND SIZES.

Total Number of Ewes.	Number of Years Established.				
	0–20 Years.	20–40 Years.	40–60 Years.	60–80 Years.	Over 80 Years.
0–1,999	12	5	3	..	..
2,000–3,999	3	4	..	..	..
4,000–5,999	2	2	1	2	1
6,000–7,999	..	..	2	2	..
8,000–9,999	..	..	..	1	..
10,000–11,999	..	1	..	..	..

TABLE 2.

SHOWING THE NUMBER OF STUDS TURNING OFF DIFFERENT NUMBERS OF RAMS PER ANNUM.

Average No. of Rams.	1-100.	101-200.	201-300.	301-400.	401-500.	501-600.	601-700.	701-800.	801-1,000.	1,001-1,200.	1,201-1,400.	1,400 Over.
Number of Studs ..	8	7	4	3	2	1	4	4	2	2	1	1

Maintaining the Quality of Sheep.

The quality of any particular strain of Merino sheep depends upon the inherent capacity of the animals to produce and reproduce under the environmental conditions in which they are run. Large differences in the amount of wool cut by the sheep in any flock occur, and these variations can be reduced by culling the light cutters. This has the effect of increasing the average cut per head of the remainder. The extent to which various levels of culling will raise the average cut per head of the sheep in any flock depends upon the difference between and the proportion of low and high cutters. Assuming that there is a fairly even proportion of low and high cutters in a flock, the increase in the average cut per head of the sheep selected, after different rates of culling, is as indicated in Figure 1. This shows the increase in the cut per head obtained by culling various proportions of light cutting sheep, for different variations within the flock.

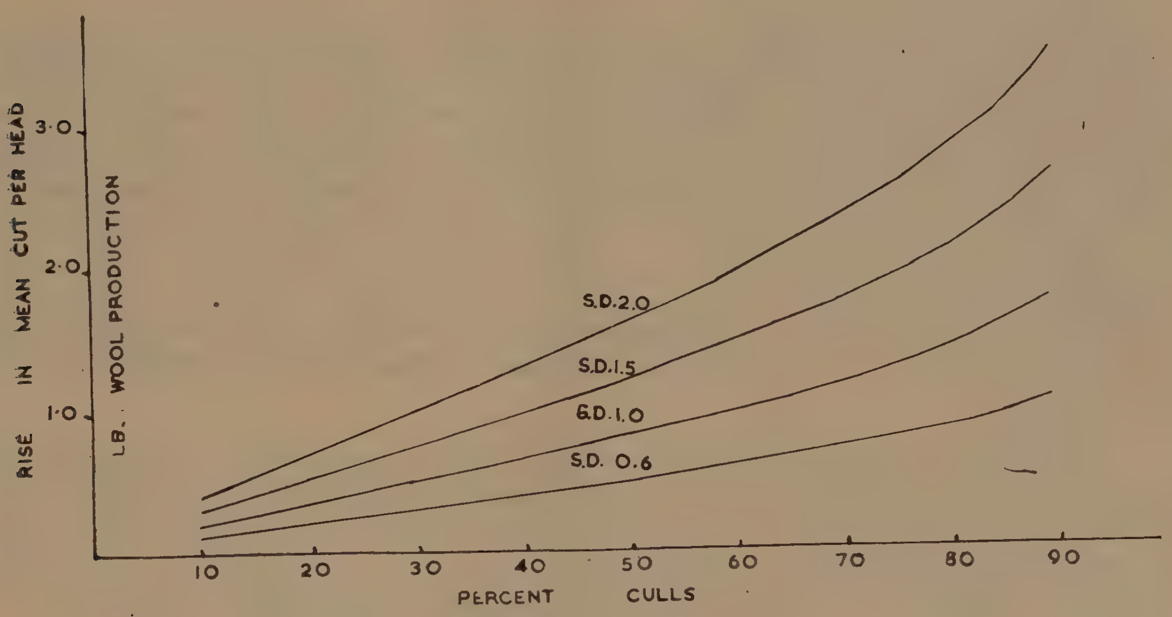


Figure 1.

The horizontal scale shows the percentage of sheep culled and the vertical scale shows the rise in the mean cut per head, in pounds of wool, as the result of culling.

The different curves show the way in which the evenness of the flock influences the result. If there is a difference of 2 lb. of greasy wool in the cut per head of the majority of the sheep in the flock, the top curve labelled S.D. 2.0 is used. If the average cut per head of the sheep in such a flock was 7.0 lb., the cut of most of the sheep would be between 6 lb. and 8 lb. of greasy wool. On the other hand, if the flock was fairly even and there was only 1 lb. between the majority of the high and the majority of the low cutters, the curve second from the bottom would be used. Actually there are few unclassed flocks as even as these figures would suggest, but it is possible to use this graph when considering the clean scoured wool produced by the individuals in a flock.

Suppose that the variation between the cut per head of the majority of the heavier and lighter cutters in a flock was 2 lb. of wool, and the owner wished to determine the effect of culling 25% of the sheep. A perpendicular is erected from 25 on the horizontal scale until it cuts the curved line marked S.D. 2.0. From this point a horizontal line is drawn back to the vertical scale, which it would cut at about the level of 1.0 lb. In other words, culling 25% of the young sheep on their cut per head would increase the average cut per head of those classed into the flock by about 1.0 lb.

(Figure by Miss H. Turner, C.S.I.R.O. McMaster Laboratory.)

The removal of 25 per cent. to 30 per cent. of the light cutters would not ensure, however, that the offspring of the heavier cutters which were retained in the flock would be better producers than the original flock. The productivity of the offspring would depend upon a number of factors, included in which are:—

(1) The productivity of the rams which sired the offspring from the heavy cutting ewes.

(2) The extent to which the increase in the cut per head of the sheep selected for breeding is influenced by heredity and the extent to which it is influenced by environment.

Suppose, for example, that a woolgrower has what so many people like to call an "average flock." Th s term probably means to some people that the wethers from that flock cut 30 bales per thousand and that the ewes cut about 7.0 lb. of greasy wool per head per year. These are loose criteria to adopt as indicating "average productivity."

If the presser engaged at shearing time is a good man, the bales might average 320 lb. If he is not so capable they may average 292 lb. After the 11·0 lb. tare is deducted for the weight of the pack, it is seen that the heavier bales would contain 309 lb. of greasy wool and the lighter 281 lb. By simple multiplication and division it is clear that in the former case the average cut per head of the wethers was 9.27 lb. $\left(\frac{309 \times 30}{1{,}000}\right)$ and in the latter it was 8.43 lb. $\left(\frac{281 \times 30.}{1{,}000\ .}\right)$ This is a difference of over ¾ lb. of greasy wool per head, so the term 30 bales per thousand is not a very exact measure of the actual productivity of the wethers!

Similarly, if an effort is made to measure the actual weight of the fleeces cut by a number of the ewes it will probably be found that some ewes will cut 5¼ lb. of wool while others will cut as much as 9 lb. If the fleeces from enough ewes are weighed, it will probably be found that a result somewhat as shown in Table 3 would be obtained.

TABLE 3.

SHOWING NUMBER OF FLEECES IN EACH WEIGHT GROUP OBTAINED FROM WEIGHING 300 FLEECES AS THEY WERE SHORN.

Greasy Fleece Weight (lb.)	5¼.	5½.	5¾.	6.	6¼.	6½.	6¾.	7.	7¼.	7½.	7¾.	8.	8¼.	8½.	8¾.	9.
Number of Fleeces ..	2	5	9	17	24	33	38	41	38	32	24	16	11	5	3	2

These figures are plotted on a graph, in Figure 2, which shows that there is a fairly even distribution of the number of fleeces in each weight class arranged around the average weight of 7.0 lb.

This immediately raises questions as to why some sheep grow only 5 lb. 4 oz. of wool in a year while others cut as much as 9.0 lb. The reasons for this might be quite simple. Some of the ewes may have suffered from fly strike or they may have been affected by a light infestation of internal parasites. Some of the ewes may have reared lambs; a few probably reared twins! The number of lambs reared could have a tremendous effect on the productivity of the flock; in fact, it could make a difference of over half a pound in the average fleece weight.

More surprising, however, is the realisation that the type of birth, whether it be single or twin, and the age of the mother at the time of the lambing can have a substantial effect on the productivity of lambs throughout their lifetime. It is by no means improbable that the ewes which cut 5 lb. or 6 lb. of wool were either twins or the first lambs from the mating of a flock of maiden ewes. Their disadvantage in life is an accident of birth and is not due to inferior inheritance!

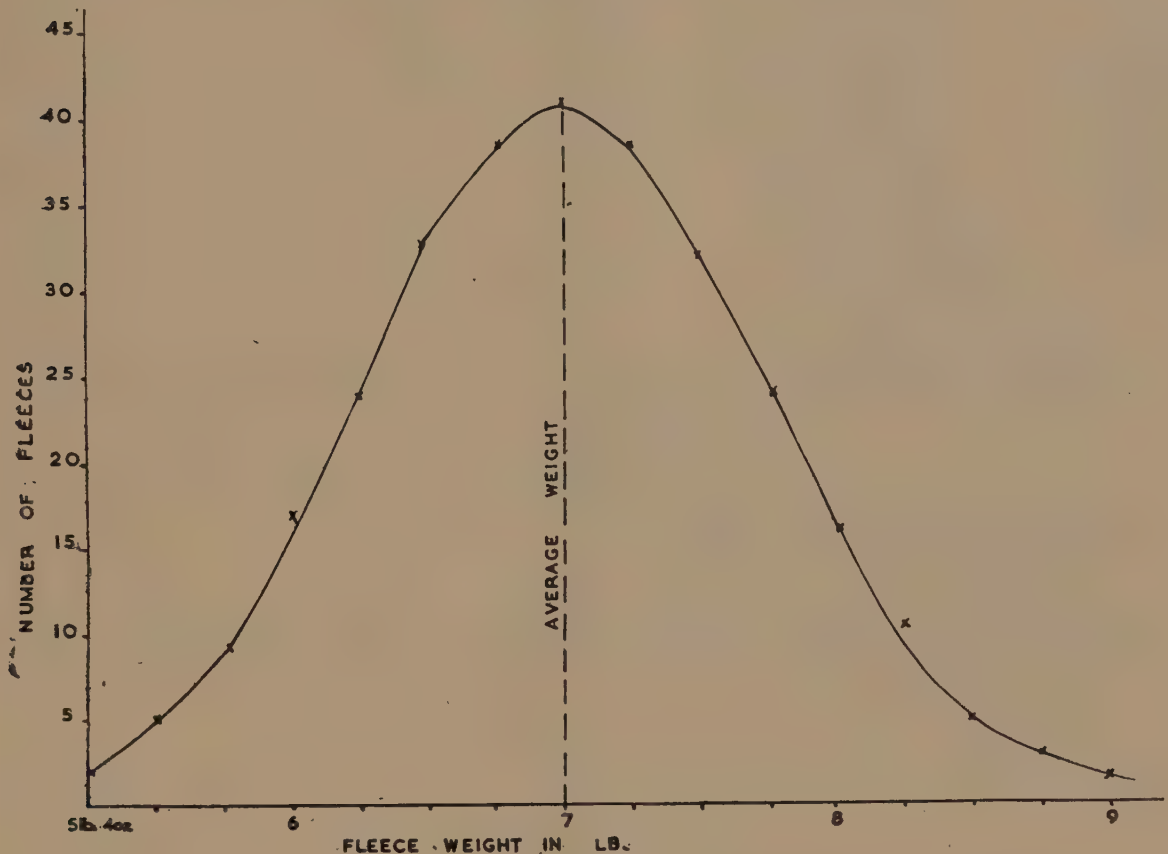


Figure 2.

The horizontal scale shows the fleece weight in pounds of greasy wool and the vertical scale shows the number of fleeces.

It is noted that the different values are distributed fairly evenly on either side of the average or mean, and they taper off to the lowest and highest values. However, the majority of the fleece weights fall into a group within about 1 lb. on either side of the mean or average weight of 7 lb. This is known as a curve of normal distribution.

If it is desired to find the number of fleeces which weighed 6 lb., a vertical line is erected from the point marked 6 lb. on the horizontal scale until it intersects the curved line. A horizontal line is drawn through this point until it intersects the left hand vertical scale at 17.

If the sheep whose fleeces were weighed were culled on the basis of their cut per head, the last 75, representing 25 per cent. of the flock, would be removed as indicated in Figure 3. This would mean that the average cut per head of the sheep removed was 6 lb. 1 oz. and that of the remainder would increase to 7 lb. 4½ oz. However, in practice things might not turn out just like that! Some sheep which were quite heavy cutters would probably be culled because of colour, turkey hocks, bad feet or mouths and other faults of conformation. If the weight of the fleeces cut by the culls and the ewes "classed in" were plotted on a graph, the result would be similar to that presented in Figure 4, which is drawn from Table 4.

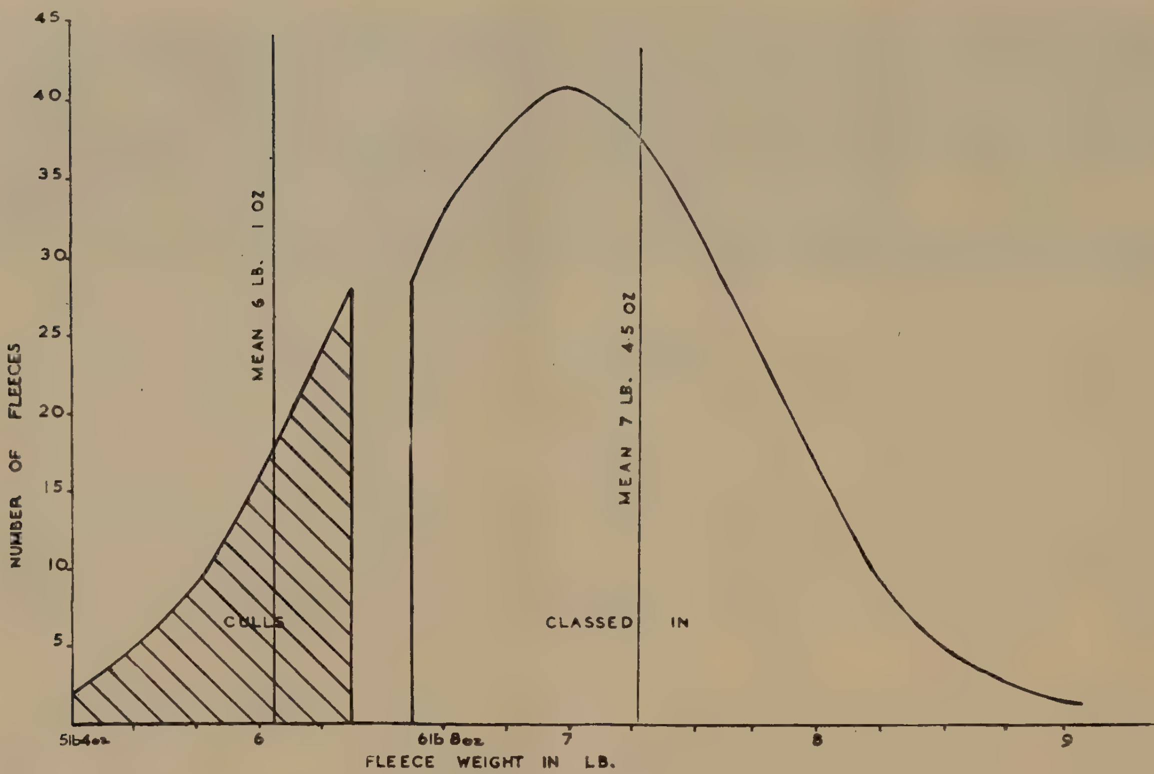


Figure 3.

The horizontal scale shows the fleece weight in pounds and the vertical scale shows the number of fleeces.

The 25% of lowest cutters have been culled (solely on fleece weight) and the horizontal scale has been broken at 6 lb. 6 oz. to allow for a clear distinction between the culls, which are shaded, and those classed into the flock.

The average weight of the fleeces cut by the culls is 6 lb. 1 oz. and those classed into the flock 7 lb. 4½ oz.

TABLE 4.

SHOWING THE GREASY FLEECE WEIGHTS CUT BY THE CULLS AND THOSE CLASSED INTO THE FLOCK.

Fleece Weight (lb.)	5¼.	5½.	5¾.	6.	6¼.	6½.	6¾.	7.	7¼.	7½.	7¾.	8.	8¼.	8½.	8¾.	9.
Ewes Culled	2	2	5	10	13	13	12	9	5	2	1	1	..	..	..	..
Ewes "Classed in" ..	..	2	4	7	12	20	26	32	33	30	23	15	11	5	3	2

Care should be taken to compare the average weight of the fleeces cut by the sheep classed into the flock with that shown for the unclassed flock in Figure 2. This reveals that the small gain of 3 oz. in the average cut per head has resulted from the classing; that is to say, one-third of the advantage of culling on the cut per head has been lost.

One other factor has to be considered in relation to the maintenance of the quality of sheep. The average lamb-marking percentage of flocks in Queensland is low. Many flocks in the more favoured south-eastern part of the State record higher lamb-marking percentages than those in the central and northern areas, but it is well to remember that the average ewe, which is mated six times in a flock in which 50 per cent. of lambs are marked consistently, rears in her lifetime only three offspring to marking age. Each ram in the same flock would sire something like 80 offspring if he remained useful for four matings. These figures indicate that there is infinitely more scope for the improvement of the genetic quality of the State's flock by working through the selection of rams than through the classing of ewes.

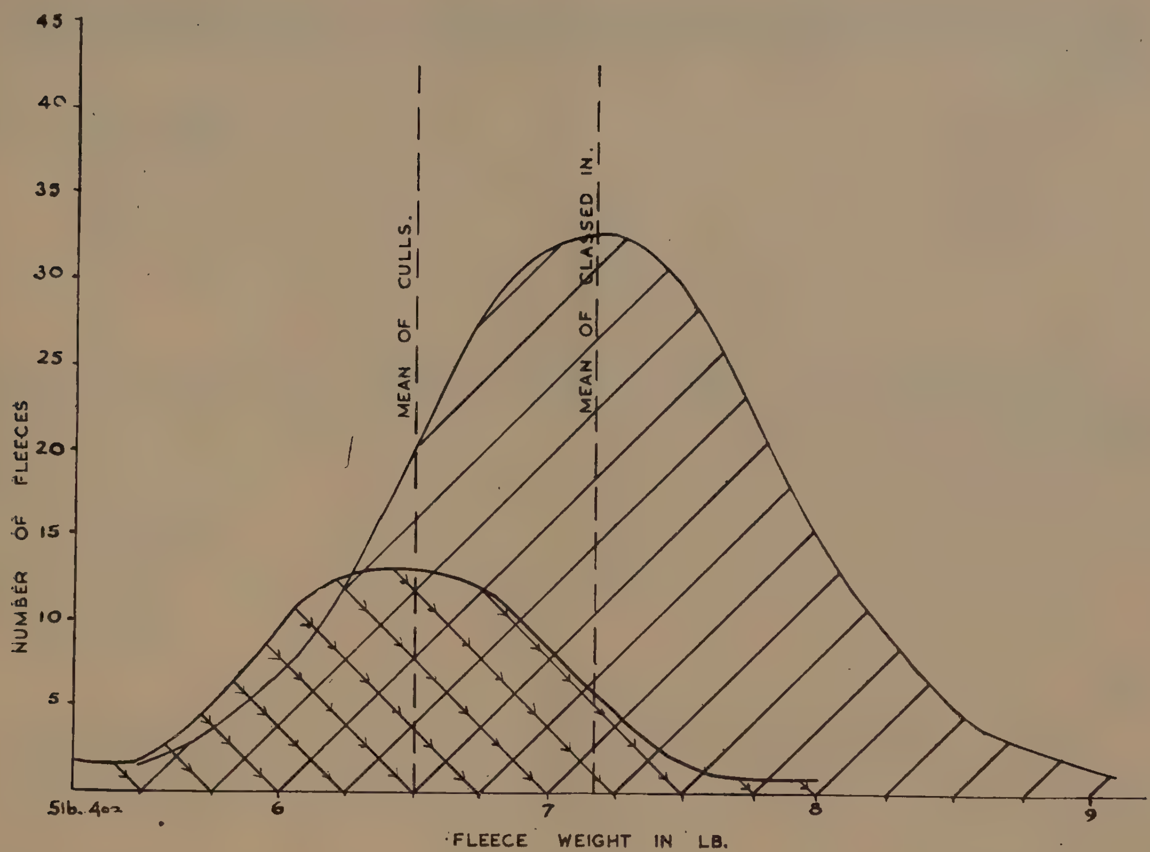


Figure 4.

The horizontal scale shows the fleece weight in pounds and the vertical scale shows the number of fleeces.

The sheep have been classed on the basis of cut per head and conformation. The culls occupy the herringboned portion of the graph. Their average cut per head is 6 lb. 8 oz. while that of the sheep which have been classed into the flock is 7 lb. 3 oz.

These figures show how there is some overlapping of the actual cut per head of the culls and the sheep which are classed into the flock. Some of the heavier cutters amongst the culls have been removed because of faults of conformation.

Ram Requirements of the Queensland Merino Sheep Industry.

Because of the variations experienced in seasonal conditions in Queensland, different numbers of ewes have been mated each year. The actual numbers of ewes mated between 1937 and 1950, are shown in Table 5, which also presents the number of rams required to allow for a 2½ per cent. joining.

TABLE 5.

SHOWING THE NUMBER OF FLOCK EWES MATED EACH YEAR IN QUEENSLAND AND THE APPROXIMATE NUMBER OF RAMS NEEDED FOR JOINING WITH THE EWES.

Year.	Ewes Mated.	Rams Required.	Year.	Ewes Mated.	Rams Required.
1937	8,869,722	221,743	1944	6,872,188	171,805
1938	8,532,431	213,311	1945	6,432,751	160,809
1939	9,616,702	240,418	1946	5,990,869	149,772
1940	9,337,131	233,428	1947	6,540,702	163,518
1941	8,863,084	221,577	1948	6,159,620	153,991
1942	8,389,036	209,726	1949	6,847,643	171,191
1943	7,417,252	185,431	1950	6,858,001	171,450

The five-year averages of the number of ewes joined were as follows:—

1937-41	9,043,814
1942-46	7,020,019
1946-50	6,479,367

Allowing a useful life of four years after his first joining for a ram, the approximate annual replacements of rams required by the sheep industry were as follows:—

1937-1941	45,000
1942-1946	35,000
1946-1950	30,000

Initially, the majority of these rams came from studs in New South Wales, but more recently the studs in Queensland have supplied a large proportion of the State's requirement. This is made perfectly clear from the figures in Table 6 showing the total number of Merino rams purchased by woolgrowers in Queensland each year. The State of their origin is given and the percentage is also shown.

TABLE 6.

SHOWING THE TOTAL NUMBER OF RAMS PURCHASED EACH YEAR BY WOOLGROWERS IN QUEENSLAND AND THE STATES IN WHICH THEY ORIGINATED.

Year.	Total Number of Rams.	Number from New South Wales.	Number from Queensland.	Percentage Bred in Queensland Studs.
1936	..	26,683	..	..
1937	40,984	26,262	14,722	36
1938	38,216	21,065	17,151	45
1939	37,975	15,533	22,442	59
1940	42,755	18,873	23,882	56
1941	48,329	21,416	26,913	56
1942	27,358	10,998	16,360	60
1943	42,328	19,279	23,049	54·5
1944	40,001	19,444	20,557	51·5
1945	33,675	13,877	19,798	59
1946	28,366	9,395	18,971	67
1947	48,831	19,637	29,194	60
1948	30,336	8,493	21,843	72
1949	43,266	13,230	30,036	69

In view of the important role that the sheep studs in Queensland are playing in supplying the State's annual requirement of rams, it might be as well to examine the available figures pertaining to their breeding performance. These have been taken from the last 15 volumes of the Australian Stud Merino Flock Register.

How Many Rams Can a Stud be Expected to Produce for Sale?

Four factors will influence the number of rams a stud can produce for sale. These are:—

(1) The number of ewes mated.

(2) The percentage of lambs marked to ewes mated.

(3) The losses between marking and classing.

(4) The percentage of rams culled at classing time.

The number of ewes mated varies from stud to stud and from season to season. However, any unit such as 100 or 1,000 ewes can be adopted for basic calculations. The average lamb-marking percentages also vary; from the records contained in the Australian Stud Merino Flock Register it is clear that these have varied between 21 per cent. and 85.4 per cent. Most stud masters state that losses amongst young rams are rather high and field experience supports the claim.

The relationship between these factors is demonstrated in Tables 7 and 8, which show the number of rams left for sale at various lamb-marking percentages, percentage losses and culling rates.

TABLE 7.

SHOWING THE NUMBER OF RAMS LEFT FOR SALE AFTER MATING 100 EWES AND ALLOWING FOR DIFFERENT LAMB-MARKING PERCENTAGES AND CULLING RATES AND AN ANNUAL LOSS OF 10 PER CENT BETWEEN MARKING AND CLASSING.

Number of Lambs Marked per 100 Ewes.	Number of Ram Lambs Marked.	First Year. 10% Loss.	Second Year. 10% Loss.	Number of Rams left at Various Culling Rates (to nearest whole) Number).		
				Culling 20 Per Cent.	Culling 25 Per Cent.	Culling 30 Per Cent.
95	47·5	42·8	38·5	31	29	27
90	45	40·5	36·4	29	27	26
85	42·5	38·3	34·4	28	26	24
80	40	36·0	32·4	26	24	23
75	37·5	33·8	30·4	24	23	21
70	35	31·5	28·4	23	21	20
65	32·5	29·3	26·3	21	20	18
60	30	27·0	24·3	19	18	17
55	27·5	24·8	22·3	18	17	16
50	25	22·5	20·3	16	15	14
45	22·5	20·3	18·2	15	14	13
40	20	18·0	16·2	13	12	11
35	17·5	15·8	14·2	11	11	11
30	15	13·5	12·2	10	9	8
25	12·5	11·3	10·2	8	8	7
20	10	9·0	8·1	6	6	6

It is clear from these tables and from the lamb-marking percentages recorded by the various studs that, even if losses and culling rates are low, few studs could sell more than 20 rams from every 100 ewes mated.

From an analysis of the figures contained in the Australian Stud Merino Flock Register it is clear that some studs have been selling a greater number of rams per 100 ewes mated, and in view of the lamb-marking percentages they have recorded it is not clear how this has been

achieved. No doubt allowance would have to be made for the effect of some carry-over of rams unsold at the commencement of the period under review, but this effect would decrease as time increased. For this reason, the data in Table 9 are only from stud records available for more than seven years.

TABLE 8.

SHOWING THE NUMBER OF RAMS LEFT FOR SALE AFTER ALLOWING FOR DIFFERENT LAMB-MARKING PERCENTAGES AND CULLING RATES AND AN ANNUAL LOSS OF 5 PER CENT. BETWEEN MARKING AND CLASSING.

Number of Lambs Marked per 100 Ewes.	Number of Ram Lambs Marked.	First Year. 5% Loss.	Second Year. 5% Loss.	Number of Rams left at Various Culling Rates (to nearest whole Number).		
				Culling 20 Per Cent.	Culling 25 Per Cent.	Culling 30 Per Cent.
95	47·5	45·1	42·8	34	32	30
90	45	42·8	40·6	32	30	28
85	42·5	40·4	38·4	31	29	27
80	40	38·0	36·1	29	27	25
75	37·5	35·6	33·8	27	25	24
70	35	33·3	31·6	25	24	22
65	32·5	30·9	29·3	24	22	20
60	30	28·5	27·1	22	20	19
55	27·5	26·1	24·8	20	19	17
50	25	23·8	22·6	18	17	16
45	22·5	21·4	20·3	16	15	14
40	20	19·0	18·1	14	14	13
35	17·5	16·6	15·8	13	12	11
30	15	14·3	13·5	11	10	10
25	12·5	11·9	11·3	9	8	8
20	10	9·5	9·0	7	7	6

TABLE 9.

SHOWING THE NUMBER OF RAMS SOLD PER 100 EWES MATED IN RELATION TO THE LAMB-MARKING PERCENTAGES IN A NUMBER OF QUEENSLAND STUDS.

Lamb-marking Percentage.	Rams Sold per 100 Ewes Mated.							
	0–5.	5·1–10.	10·1–15.	15·1–20.	20·1–25.	25·1–30.	30·1–35.	35·1–40.
80·1–90 ..	..	..	1	1	..	1	..	..
70·1–80 ..	..	..	..	1	..	..	..	..
60·1–70 ..	..	..	1	3	..	..	1	..
50·1–60 ..	..	1	3	8	2	..	..	1
40·1–50 ..	1	..	1	1	..	..	..	..
30·1–40 ..	..	..	2	..	..	..	..	..
20·1–30 ..	..	..	..	1	..	..	..	..

The figures presented in Tables 7 and 8 are based on the assumption that culling rates are between 20 per cent. and 30 per cent. However, there is no clear-cut evidence that this is the case. From an analysis of figures from a number of volumes of the Australian Stud Merino Flock Register, it is possible to calculate the number of rams sold in relation to the number of ram lambs born.

Table 10 has been compiled to show the results obtained from doing this. It shows the relation between the mean number of rams sold per year and the percentage of ram lambs born which are sold as rams (assuming rams are sold at two years of age). These figures for rams and lambs are taken from stud records which have been available for more than five years.

TABLE 10.

SHOWING THE AVERAGE NUMBER OF RAMS SOLD PER ANNUM AND THE AVERAGE PERCENTAGE OF RAM LAMBS BORN WHICH ARE SOLD AS RAMS.

Average Number of Rams Sold per Annum.	Average Percentage of Ram Lambs Born Sold as Rams.						
	30–40.	40·1–50.	50·1–60.	60·1–70.	70·1–80.	80·1–90.	90·1–100.
1,401–1,500 ..	..	..	..	..	..	..	1
1,301–1,400 ..	..	..	..	1	..	..	..
1,201–1,300 ..	..	..	..	..	..	..	..
1,101–1,200 ..	..	..	..	..	1	..	..
1,001–1,100 ..	..	..	..	1	..	..	..
901–1,000 ..	..	..	..	..	..	..	..
801–900	..	..	1	..	..	..	..
701–800	1	..	1	1	..	..	..
601–700	..	1	1	1	..	..	..
501–600	..	..	..	..	..	..	..
401–500	..	..	1	..	..	1	..
301–400	..	..	1	..	..	..	..
201–300	1	..	..	..	..	..	..
101–200	..	..	..	1	..	..	..
0–100	1	..	..	..	..	1	..

How Can Vital Statistics be Used to Measure the Progress Made in a Stud?

The way in which vital statistics can be used to determine the number of young ewes that have to be "classed in" to maintain numbers in any flock experiencing different lamb-marking percentages and percentage losses was outlined in the first article of this series. From the viewpoint of the stud master, vital statistics are of particular importance because they indicate the degree of selection that is possible, selection being usually considered to be one of the corner-stones of animal breeding. It is important, therefore, to know exactly what degree of selection can be practised. It is equally important, of course, to know what will be the effect of different levels of selection.

The degree of selection that can be practised depends upon the balance between the births and deaths in the flock. The age to which sheep are kept can be used in adjusting the balance either way, provided the differences between death rates and birth rates are not too great.

A number of factors influence the birth rate. The number of conceptions amongst the ewes, and the proportion which are carried to full term, control the number of lambs born. Most sheep men agree that the fertility of older ewes is greater than that of younger ewes. This is certainly borne out by field observations made by officers of the Sheep and Wool Branch, who have found that fewer conceptions occur amongst young ewes. This difference is accentuated by the greater number of pairs of twins which are born to the older ewes. The overall position is presented in Figure 5, which was prepared by Dr. R. B. Kelley, of C.S.I.R.O.

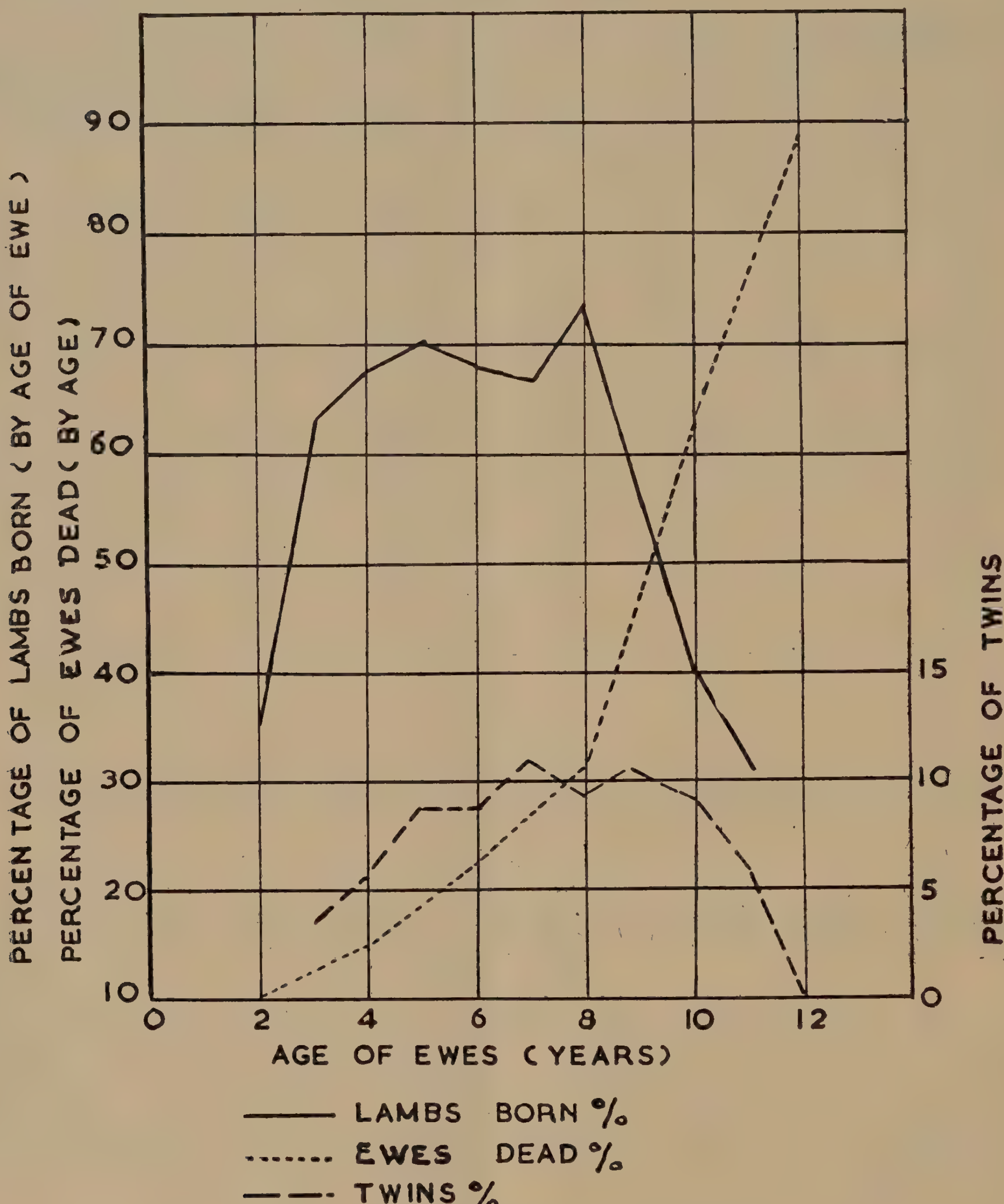


Figure 5.

Showing the relationship between fertility, twinning, mortality and age.

The horizontal scale represents the age of the ewes. There are two vertical scales. That on the left represents both the percentage of lambs born and the percentage of lambs which died and refers to the unbroken and the dotted lines of the graph. That on the right represents the percentage of twins and applies to the broken line of the graph.

It can be seen that after ewes have attained the age of eight, the following occur:—(1) rapid decrease in fertility, (2) rapid increase in mortality of lambs, and (3) rapid decrease in twinning.

Figure by Dr. R. B. Kelley.)

Losses between marking and first lambing decrease the number of females which survive to bear lambs. It has recently been shown that losses between birth and marking are quite serious. Unfortunately, not many stud masters have realised the proportions these losses reach, although it has been demonstrated clearly by one stud that it is possible to mark at least 120 per cent. of lambs from stud Merino ewes for several years in succession.

Losses of rams between marking and first mating are seldom publicised, but these are also important because they influence the degree of selection which can be practised amongst sires.

The loss of ewes between lambings influences the number available each year for parenthood, while the loss of rams between matings influences the chances they have of becoming fathers of future generations. Losses amongst rams have to be counted in terms of loss of fertility as well as actual deaths. In a survey of rams in studs and flocks in central-western and north-western Queensland, it was found that 25 per cent. of rams were suffering from some condition or other which would make them permanently infertile. Comparatively few young rams were affected, while many of the older animals were quite incapable of siring lambs. The association between increasing age and increasing infertility is shown by Table 11, which has been compiled from results obtained from a field survey in north-western Queensland.

TABLE 11.

SHOWING PERCENTAGE OF RAMS STERILE IN RELATION TO THEIR AGE AMONGST THOSE EXAMINED IN NORTH-WESTERN QUEENSLAND.

Age of Rams.	2 Years.	3 Years.	4 Years.	5 Years.	6 Years.
Percentage of Rams Sterile	2·8	12	25	50	87

The occurrence of infertility amongst rams could easily escape the notice of stud and flock masters unless the animals are mated singly and definite records are kept. However, members of the staff of the Sheep and Wool Branch are familiar with the factors influencing the fertility of rams and they have assisted a number of woolgrowers by examining the ram flock prior to joining.

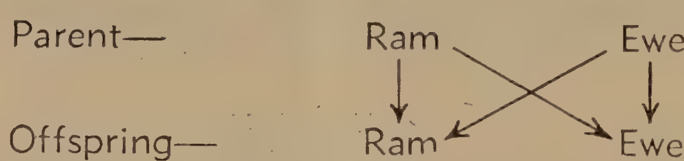
Because so few rams are selected for use in each stud, the balance between births and deaths is not quite so important from the point of view of the survival of the flock and the quality of the rams determines the extent to which they might be used. Although rams are most frequently selected on their appearance, their capacity as breeders really determines their quality. There is a tendency amongst stud breeders to use for as long as possible a ram which has proved himself capable of siring outstandingly superior offspring. This seems safe enough, but such a practice defeats its own purposes because it increases the length between generations, which decreases the rate at which progress can be made.

What Is Generation Length?

Plants which are annuals set their seed each year, and soon afterwards they wither and die. Later, when seasonal conditions are favourable some of the seeds germinate and a new generation springs up, so that each year sees the passing of a generation. However, not all the seeds may germinate during the first year, but the majority of these probably grow during the second year, so there may be some overlapping of generations.

Animals are more like perennial plants, which grow continuously year in, year out, but periodically set seed which germinates during successive seasons. As a result there is a continuous phase of overlapping generations and unless individual pedigrees are known it is difficult to determine the time which elapses between one generation and the next. However, if it is possible to find the age of the parents at the birth of each offspring, an overall figure, which can be called the average generation length, can be obtained by taking the arithmetical average of all these figures.

As ewe lambs and ram lambs are considered separately, there are four paths from generation to generation and it is convenient to separate them in a way shown in the following diagram:—



All that is necessary is to find the average length of each of these paths, add up the four figures and divide the total by 4 to get the average generation length. Obviously low lambing percentages increase generation length.

Each year a portion of a generation is culled and the remainder is classed into the flock. If average generation length is four years, a whole generation is culled every four years.

However, if rapid progress is to be made greater interest attaches itself to the amount of selection that can be practised per year rather than per generation, but the generation length is still important. If the same amount of selection is practised in two flocks, one of which has a shorter generation length than the other, it is clear that more rapid progress will be made in the flock with the shorter generation length. However, it is important to consider the four paths from generation to generation, to see what steps can be taken to keep generation length down to a minimum.

The overall relationship between generation length and the age at which sheep are cast is shown in Figure 6. This was constructed by Mr. G. McBride, of the Veterinary School within the University of Queensland, from vital statistics collected by Mr. W. Granger from the Haddon Rig Stud. It is seen that as the age of casting increases the generation length also increases, and as the ewes on many properties are cast after attaining seven years of age the average generation length is in the vicinity of $4\frac{1}{2}$ years.

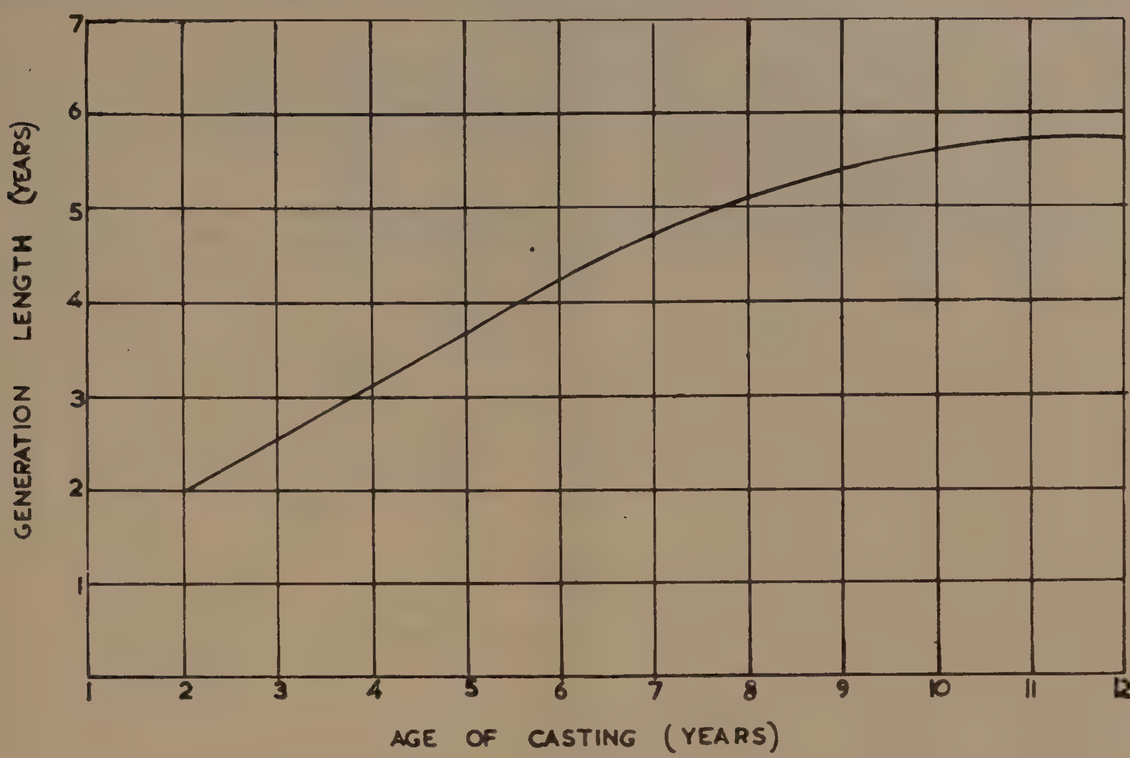


Figure 6.

This shows the relationship between the generation length from ewe to ewe in years and age at which ewes are cast.

The figure is drawn from data obtained from a property on which an average lamb-marking percentage of 62 was maintained.

The horizontal scale shows the age in years at which the ewes were cast and the left hand vertical scale shows the generation length in years. The curved line shows the relationship between the two; for instance, if the ewes are cast for age at 8 years the vertical line erected from this point is followed until it intersects the curved line. A horizontal line is drawn from this point of intersection to the vertical scale, which it intersects a little above 5 years.

Figure by Mr. G. McBride.

What Are the Effects of Selection?

Since vital statistics are useful in determining the amount of selection which can be undertaken, it is worth considering the effect of selection on breeding plans. Selection is really the choosing of potential parents, and it is hoped, of course, that they will transmit their good characters to their offspring. From the viewpoint of wool production, the most important character they can transmit is a high cut per head, and whether there is any appreciable rise in the average cut per head of the sheep selected as parents will depend on:—

(1) The amount of variation between the lightest and heaviest cutter and the number of sheep in each weight group between these two extremes.

(2) The amount of culling that can be undertaken.

Actually the figures presented in Table 3, from which Figure 2 was drawn, were collected by weighing the fleeces from 300 young sheep as they were shorn. The effect of culling different proportions of the ewes is shown in Table 12.

TABLE 12.

SHOWING THE EFFECT ON THE AVERAGE CUT PER HEAD OF THOSE RETAINED IN THE FLOCK AFTER DIFFERENT LEVELS OF CULLING.

(Average cut per head of the unculled flock = 7·0 lb.)

Percentage Culled.	Average Cut per Head of Culls.		Average Cut per Head of those Retained in the Flock.		Amount of Increase.	
	Lb.	Oz.	Lb.	Oz.	Lb.	Oz.
5	5	8	7	1	0	1
10	5	12	7	2½	0	2½
15	5	14	7	3	0	3
20	6	0	7	4	0	4
25	6	1	7	4½	0	4½
30	6	3	7	6	0	6
35	6	4	7	7	0	7
40	6	5	7	8	0	8
50	6	7	7	10	0	10
60	6	9	7	12	0	12
70	6	10	7	14	0	14
80	6	12	8	1	1	1
90	6	14	8	5	1	5

If 25 per cent. of young sheep are culled, the average cut per head of the classed flock is increased by 4½ oz. and the position is as depicted graphically in Figure 4.

The difference of 4½ oz. between the average cut per head of those selected to be parents and that of the unclassed flock is known as the selection differential, but not all of this gain will be transmitted to the offspring.

These considerations raise questions about the relationship between a stud and the flocks to which it supplies rams. Clearly this comes down to a matter of the average productivity of the two flocks and the degree of selection that is practised. Suppose ewe lambs from the same drop and from dams of the same age, from a stud and from one of the flocks to which it supplies rams, are taken and run together in the same paddock. If the fleeces from these sheep are weighed at shearing time and the results plotted on a graph, different relationships between the figures may be quite obvious, although their shape may be quite similar. If the sheep from the stud are much better than those from the flock there will be a wide difference between the curves showing the result obtained from weighing the fleeces, but if the stud sheep have not inherited a markedly greater capacity to produce wool, the curves may overlap. These positions are presented in Figures 7 and 8.

Similar results might be obtained if comparable observations were made on two groups of ram lambs obtained from the stud and the flock if they were run under similar conditions.

The difference between the average cut per head of the sheep reared and run under comparable conditions is the real measure of the superiority of one flock over another, but it is clear from Figure 8 that it could be possible to select some sheep from the flock which were superior to some of those in the stud. Unless there is a substantial difference between the average cut per head of the sheep in the stud and those in the flock when run under comparable conditions, it becomes apparent that the owner of a good flock should give careful consideration to the classing practised in the stud before he purchases rams!

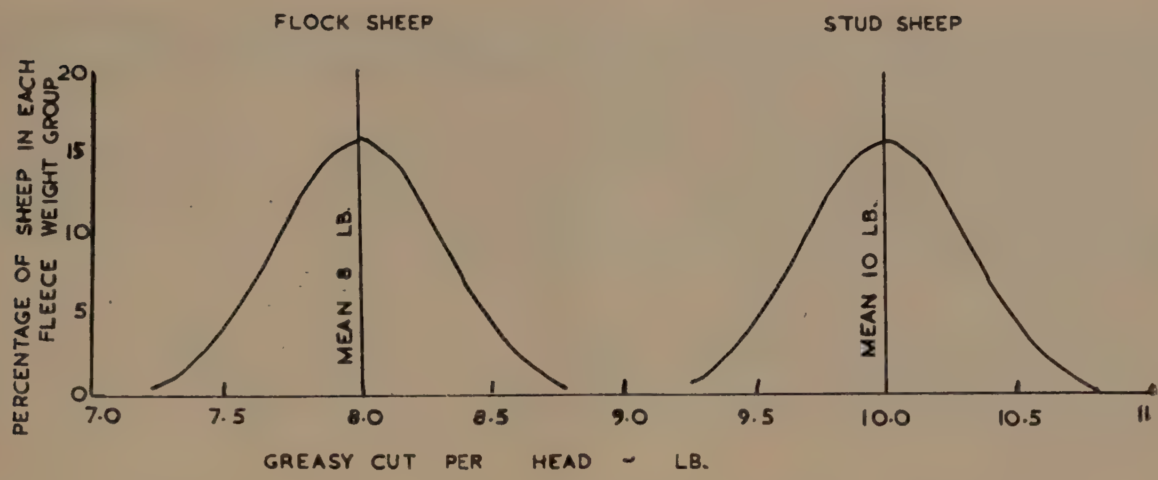


Figure 7.

This shows the percentage of sheep from a stud and a flock in each fleece weight group.

The results obtained by weighing the fleeces from the stud sheep are on the right hand side and those from the flock sheep are on the left hand side. These graphs are used in the same way as in Figure 2. The mean or average cut per head of the stud sheep is 10 lb. and that of the flock 8 lb. per head.

In this case the average of the stud sheep is clearly superior to that of the flock sheep and no sheep in the flock cut as heavily as those in the stud.

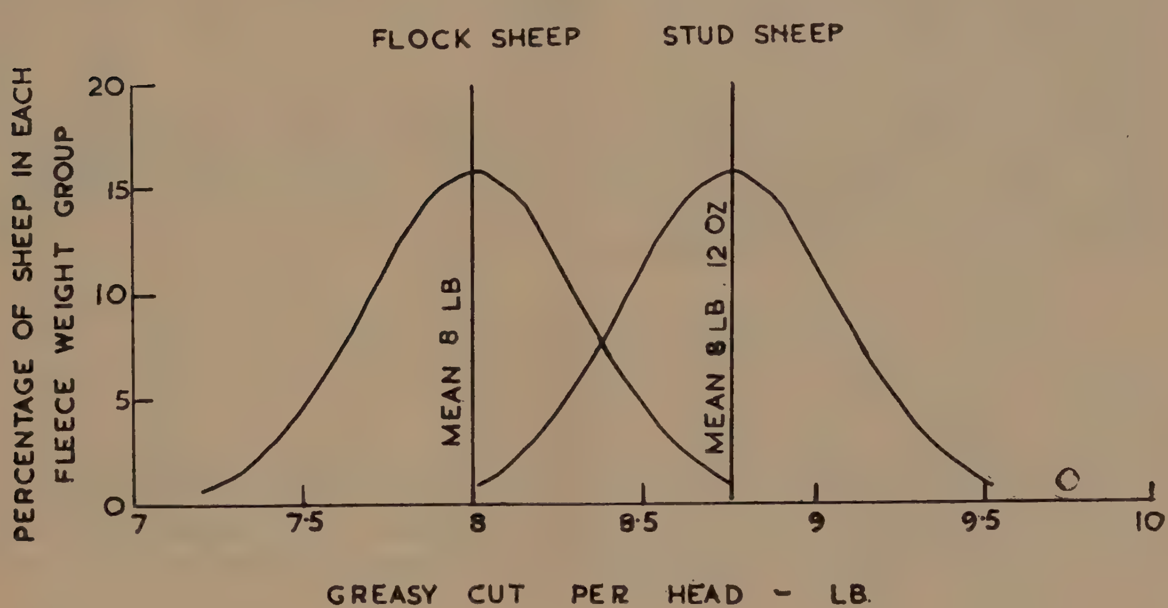


Figure 8.

This shows the result of a similar observation to that from which Figure 7 was drawn, except that in this case the stud sheep are not so markedly superior to those bred in the flock.

The average cut per head of the stud sheep is only 12 oz. above that of the flock sheep and there are quite a number of sheep in the flock which are superior as producers to those in the stud.

On the other hand, if 25 per cent. of the young sheep dealt with in Table 12 are selected (that is, 75 per cent. are culled) the position is reversed, as the few sheep at the upper end of the curve in Figure 8

would be selected. The average cut per head of these sheep could be in the vicinity of 7 lb. 15½ oz., so the selection differential in this case would be 7 lb. 15½ oz.—7 lb.=15½ oz.

It is seen from Table 12 that if the 10 per cent. of heaviest cutters were selected the average cut per head would be 8 lb. 5 oz. (that is, 1 lb. 5 oz. above the average of the unclassed flock). This would increase the selection differential quite appreciably.

These examples broadly present the position as it occurs in stud flocks in Queensland. Selection amongst ewes is often at about the 75 per cent. level; that amongst rams within a stud is at about the 10 per cent. level.

Unfortunately, figures relating to cuts per head are not available from more than one Merino sheep stud in Queensland, but facilities for their collection now exist. They can be obtained quite easily by dividing the culls from the sheep classed into the flock prior to shearing. The fleeces from the culls can be weighed separately and those from the sheep classed into the flock can also be weighed as a group and the average cut per head calculated.

Of course, this would be impossible if large numbers of sheep are involved, but this difficulty can be overcome by weighing each fleece as it comes from the board and before it is thrown on the wool table. An accurate clock-face scale and a notebook are all the equipment required. Suitable scales are available to the field officers of the Sheep and Wool Branch, who would be pleased to assist any stud master who wished to collect such information.

The importance of doing this cannot be stressed too strongly. It would give an immediate assessment of the progress that was being made as the result of selection, and information of this type is an essential part of any critical examination of the progress that is being made by current methods of animal breeding.

If weights of the fleeces cut by the cull ewes and the remainder of the flock are obtained, approximately one-quarter of the story about progress in any stud will be known, but it will be the first and most important quarter. The other three-quarters will include information about the rams with which the ewes are mated, that proportion of the superiority of the parents which is transmitted to their offspring, and the way in which they are mated. This last point is the most important from the point of view of vital statistics because it influences the time which elapses between generations.

At What Age Should Ewes be Cast?

Two factors have to be considered in deciding upon the age at which ewes should be cast. They are:—

(1) The balance between births and deaths.

(2) The rate at which genetic progress can be made.

The former has been dealt with in some detail in previous articles in this series, but there are some interesting aspects pertaining to the rate at which genetic progress can be made. This is dependent upon the degree of culling that is practised in relation to the amount of variation there is within the population. The selection differential gives a practical

measure of both of these factors and a relationship can be established between this and the age at which ewes are cast. The results obtained from doing this are presented in Figure 9, which compares the rate of progress made by casting ewes at different ages for different selection differentials. It is seen that the rate of increase of genetic progress is most rapid if the sheep are cast between five and six years. However, the rate of progress decreases rapidly after the ewes pass their sixth year, even if the selection differential is very high.

It is clear, therefore, that a greater rate of genetic progress is attained if the ewes are cast for age reasonably early in their life, rather than held until they attain great age.

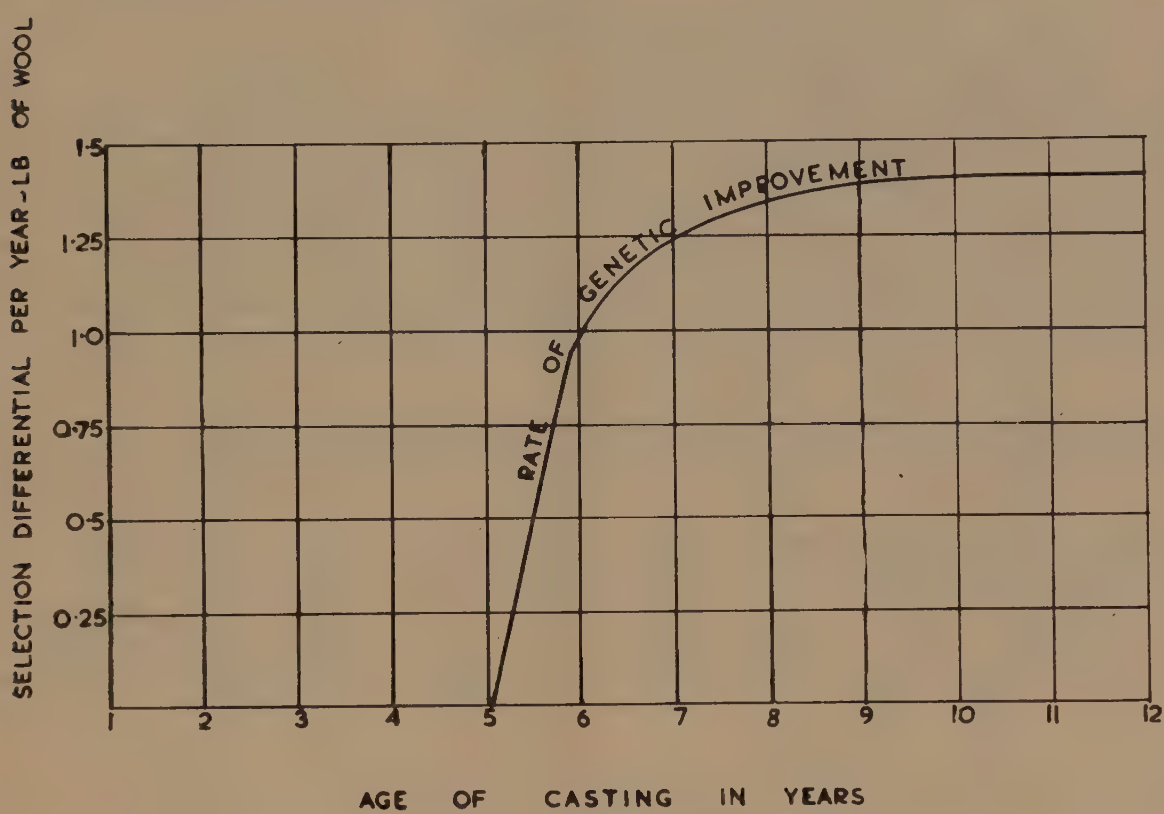


Figure 9.

This shows the relationship between the rate of genetic improvement, the age at which ewes are cast and the selection differential.

The horizontal scale shows the age at which ewes are cast and the vertical scale shows the selection differential.

The curved line shows the rate of genetic improvement. It is seen that this decreases rapidly after the ewes attain 6 years of age despite a high selection differential.

These calculations are based on the ewe to ewe path only for generation length.

Figure by Mr. G. McBride.

This figure is based on calculations embodying generation length based on the ewe to ewe path only. When the other three paths are included, a rather different picture might be obtained. However, accurate records which would permit their determination are not available and for this reason suggestions are made about the records which might be kept.

RAM RECORDS.

Ages.	Intakes.			Disposals.				Matings.					Lambs.	
									Rams.		Ewes.			
	Date.	Origin.	Numbers.	Date.	Origin.	Numbers.	Reasons.	Date.	Ages.	Numbers.	Ages.	Numbers.	Ram.	Ewe.
1 ..														
2														
3 ..														
4 ..														
5 ..														
6 ..														
7														
8 ..														
9, 10..														
Mixed														

What Vital Statistics Should be Collected by Stud Masters?

It was suggested in Part 1 of this series of articles that certain figures might be kept by flock men to throw light on increases and decreases in flock numbers. Similar figures might be collected by stud men, and the ruling suggested as being suitable for the recording of figures would be appropriate for use by studs recording figures pertaining to ewes.

A slightly different method of recording ram figures would be necessary. That shown on the opposite page is suggested as being suitable. Natural increases and purchases would be included in ''intakes'' and deaths, sales, cullings and castings for age and/or infertility would be included in ''disposals.''

Acknowledgments.

In preparing these articles information already published in the Australian Veterinary Journal by Mr. W. Granger and by Dr. R. B. Kelley and in the Queensland Year Book by the Government Statistician has been drawn upon freely.

Information made available in September. 1951, to the Sheep and Wool Extension School by Miss H. Newton Turner, of C.S.I.R.O.'s McMaster Laboratory, has also been used and Miss Turner made many helpful suggestions, besides providing Figure 1.

Figures 6 and 9 were constructed by Mr. G. McBride, of the Veterinary School of the University of Queensland, who also assisted in planning the articles.

Members of the Sheep and Wool Branch staff took an active part in drawing figures and compiling statistics and the appropriate volumes of the Australian Merino Stud Flock Register were kindly lent by the Secretary of the Queensland Merino Stud Sheepbreeders' Association.

LAPPING CORRUGATED IRON ROOFING.

When a sheet of corrugated iron is placed flat and the number of crests and hollows counted, it will be observed that there are more of one than of the other. If there are more crests than hollows, the sheet is the right way up.

Sheets are said to be lapped one corrugation when both sheets are laid the right way up and the crest of one fits over the crest of the other. This lap is used for roofs in dry areas or for walls.

The standard lap for roofs is one and a-half corrugations, the sheets being laid with every second one upside down and with one crest and one hollow of each sheet matched. This lap is used for wall sheeting where special protection from driving rain is required.

The standard sheet with ten 3-inch corrugations has an overall width of 2 feet 7½ inches. Lapped one corrugation, its coverage is 2 feet 6 inches; lapped one and a-half corrugations, it is 2 feet 4½ inches.

Milch Goats.

G. I. ALEXANDER, Cattle Husbandry Branch.

IN many countries, goats represent a high proportion of the livestock population. In Australia, they have not yet attained the popularity reached overseas, this being largely due to the spaciousness of our country. Goats are most popular where the little land available must

Plate 157.
Goats on Pasture.

be utilised to its fullest capacity. There is a steadily increasing demand for goats in Australia from people living in the towns and cities who are not in a position to keep a cow. A cow costs about as much to feed as six or eight goats and she grazes over a correspondingly larger area. Goats have a further advantage over the cow as they are by nature browsing animals and will readily eat shrubs and bushes (Plates 158 and 159).

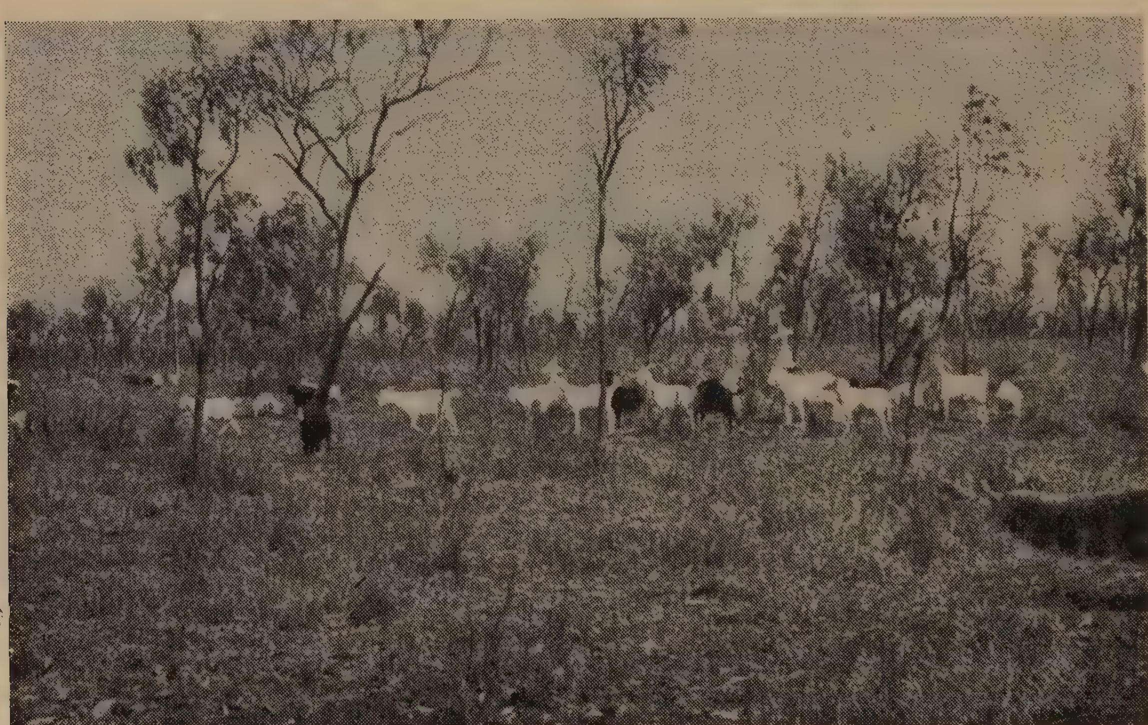


Plate 158.
Goats Browsing in North-western Queensland.

In inland Queensland, large numbers of goats are found but they are generally inferior as milkers. Much can be done to improve the standard of these animals by the continued use of only purebred bucks. This is a matter which is receiving the attention of some local authorities and much good has been done in grading up "town-bred" goats. In inland areas, goat's milk is often the only milk available, so an improvement in production is a worthwhile step.

Plate 159.
Kids Eating Leaves from a Branch Plucked from a Tree.

BREEDS OF MILCH GOATS.

The most common breed of goat seen in Queensland is the Saanen (Plates 160-162), but other breeds will be described also so that goat breeders may compare their different characters.

The Saanen.

The points of a British Saanen are—A long head; facial line straight or dished with a coarse muzzle, with or without a beard; and hornless. Ears erect or pointing slightly forward but never broken or pendant; neck long and slender, with or without tassels. White, pale cream, or very pale biscuit colour is accepted, but white goats are preferred. Coats should be short, with or without a fringe down the back and down the hindquarters.

The following points are allowed but not regarded as necessary for an ideal goat:—(1) horns; (2) black spots on the nose, eyelids, ears, and udder; and (3) slightly raised bridge to the nose.

The British Saanen is usually a larger animal with a shorter, sleeker coat and longer legs than the pure Saanen.

Plate 160.

A Saanen Doe.

[*Photo. by British Goat Society.*

Plate 161.

The British Saanen.

[*Photo. by British Goat Society.*

Plate 162.
A Saanen Doe.

Plate 163.
A Toggenburg Doe.
[*Photo. by British Goat Society.*

The Toggenburg.

The Toggenburg (Plate 163) is fairly popular in the southern States.

The British Toggenburg has the following characteristics:—A long lean head, with or without a beard; horned or hornless. Facial line straight and muzzle somewhat coarse. Ears erect or pointing forward, but never broken or pendant. Neck long and slender, with or without tassels. Colour may be from fawn to dark chocolate with white facial lines along face, white legs from the knees and hocks downwards, white on the belly and on or about the tail. The coat should be short, with or without a fringe down the back and down the hindquarters.

The pure Toggenburg is very similar, with the colour being fawn and the markings cream or white.

The Toggenburg is quite a good milker.

Plate 164.

An Anglo-Nubian Doe.

[*Photo. by British Goat Society.*

The Anglo-Nubian.

The points of a typical Anglo-Nubian (Plate 164) are—Coat short with no fringe or long hair. Colour preferably black and tan, or reddish brown, with or without black or black and white markings but free from white streaks on the side of the face. The horns, if any, should be small and curve down and out. The ears must be long, wide and pendulous but not broken or twisted. The facial line should be plainly arched and the head neat, with a slight taper towards the muzzle, which should be small. The female has no beard.

The Anglo-Nubian yields rich milk with a high butterfat content. They are quite large animals.

The Angora.

The Angora goat (Plate 165) is noted for its fleece, which is known commercially as mohair. The average weight of fleece in a herd is about 2½ lb., ranging from 10-12 lb. from bucks to ½ lb. from kids. Castrated males between two and four years of age produce the best quality fleece.

Plate 165.
An Angora Buck.
[*Photo. by British Goat Society.*

The points are—Head fine, with fleece growing well over the forehead; ears wide, thin and semi-pendant, standing out and then lopping over. The horns are flat shaped, set far apart on the head, taper towards the tip, and have a slight twist which is accentuated in the female. The chief feature is the quality of the fleece, due to its length, texture, character, and freedom from hair.

Plate 166.
Plate 167.
Two Views of a Well-formed Udder.

The Standard for the Milch Goat in Australia.

The standard set out in the Goat Herd Book of Australia, as at October 1, 1947, is given below.

—	Doe.	Buck.	Perfect Score. Doe.	Perfect Score. Buck.
General Appearance— (Attractive individuality revealing vigour, feminity or masculinity with a harmonious blending and correlation of parts) Form, colour of hair and skin	5	5	..	..
Style and Quality— Active and vigorous, showing breed character and vitality. Quality of hair, soft fine and glossy. Skin, loose and pliable ..	8	10	..	..
Temperament— Alert yet docile	3	5		
			16	20
Head— Head medium length, fine, feminine in doe and masculine in buck. Forehead broad between eyes. Face—straight preferred—slightly dished—clean. Muzzle—broad strong lips not undershot, wide open nostril. Ears—upright, high on head, fine. Eyes—large, full and bright, amber colour preferred			6	10
Neck— Long, fine, clean at junction with head evenly set into shoulders, no dewlap. Stronger and thicker in the buck. Ewe neck discouraged			3	3
Forequarters— Withers lean and sharp. Shoulders—sloping, blending smoothly into body. Chine straight and strong, well developed vertebrae			10	15
Body— Barrel long. Back straight and strong to hips, wedge shaped, well rounded large and deep abdomen, well sprung ribs. Bones of ribs broad, flat, long, wide apart. Chest fairly deep and full between and back of forelegs. No depression behind shoulder blades. Loins broad level, bones prominent, slightly wider across thurls than hips. Milk veins, prominent. Rudimentary teats on buck well developed			13	15
Hindquarters— Clean and strong, not cow hocked. Pins wide, thighs thin, wide and deep—rump high and broad, level laterally, well carried out			10	15
Legs— Clean, strong and straight, feet apart giving a well poised body, pastern medium and springy			5	5
Udder (Plates 166 and 167)— Well developed according to age, nor pendulous nor unduly divided, carrying up well behind broadly attached with good fore development. Free from fleshiness, soft fine texture ..			25	..
Teats— Well shaped, well placed (not too close or too far apart); well attached to udder—large enough to be grasped easily—2½–3in. long			5	..
Bucks— Genital organs, well developed, evenly balanced and not divided			..	12
Size and Weight (height taken at withers)— Saanen—Buck, 35 in. and up, 180 lb. .. .. .. Doe, 30 in. and up, 135 lb. .. .. Toggenburg—Buck, 33–36 in., 150–175 lb. .. .. .. Does, 26–28 in., 100–135 lb.			5	5
Polled (naturally)			2	..
			100	100

(Twenty points should be deducted for horned bucks, and 10 points for neatly disbudded bucks.)

[TO BE CONTINUED.]

ASTRONOMICAL DATA FOR QUEENSLAND.

JULY.

Supplied by W. J. Newell, Hon. Secretary of the Astronomical Society of Queensland.

TIMES OF SUNRISE AND SUNSET.

At Brisbane.			MINUTES LATER THAN BRISBANE AT OTHER PLACES.					
Day.	Rise.	Set.	Place.	Rise.	Set.	Place.	Rise.	Set.
	a.m.	p.m.						
1	6.39	5.03	Cairns	9	49	Longreach	27	43
6	6.39	5.05	Charleville ..	25	29	Quilpie	37	33
11	6.39	5.07	Cloncurry	37	63	Rockhampton ..	1	19
16	6.38	5.10	Cunnamulla ..	32	27	Roma	15	19
21	6.36	5.12	Dirranbandi ..	22	16	Townsville ..	8	41
26	6.34	5.15	Emerald	12	28	Winton	29	51
31	6.31	5.17	Hughenden ..	21	49	Warwick	5	4

TIMES OF MOONRISE AND MOONSET.

At Brisbane.

Day.	Rise.	Set.
	a.m.	
1	11.41	
	p.m.	a.m.
2	12.14	12.52
3	12.51	1.51
4	1.36	2.55
5	2.29	4.01
6	3.31	5.08
7	4.40	6.12
8	5.53	7.09
9	7.05	8.00
10	8.15	8.42
11	9.21	9.20
12	10.24	9.55
13	11.26	10.27
14	..	11.02
	a.m.	
15	12.27	11.37
		p.m.
16	1.28	12.16
17	2.28	12.58
18	3.27	1.46
19	4.23	2.37
20	5.14	3.31
21	6.00	4.27
22	6.41	5.23
23	7.17	6.18
24	7.49	7.12
25	8.18	8.04
26	8.46	8.56
27	9.14	9.49
28	9.42	10.43
29	10.13	11.40
30	10.47	..
		a.m.
31	11.27	12.40

MINUTES LATER THAN BRISBANE (SOUTHERN DISTRICTS).

Charleville 27; Cunnamulla 29; Dirranbandi 19;
Quilpie 35; Roma 17; Warwick 4.

MINUTES LATER THAN BRISBANE (CENTRAL DISTRICTS).

Day.	Emerald.		Longreach.		Rockhampton.		Winton.	
	Rise.	Set.	Rise.	Set.	Rise.	Set.	Rise.	Set.
1	23	14	39	30	14	5	45	34
6	30	9	46	23	21	0	54	26
11	20	16	27	31	11	7	42	36
16	12	28	27	43	2	19	30	51
21	10	29	25	44	0	20	27	52
26	18	19	34	35	9	10	38	41
31	28	12	44	27	19	2	52	30

MINUTES LATER THAN BRISBANE (NORTHERN DISTRICTS).

Day.	Cairns.		Cloncurry.		Hughenden.		Townsville.	
	Rise.	Set.	Rise.	Set.	Rise.	Set.	Rise.	Set.
1	38	17	56	42	41	27	32	16
3	47	12	63	38	47	24	39	12
5	55	4	68	33	51	19	45	5
7	54	3	67	32	51	18	44	4
9	45	10	61	37	46	23	37	10
11	33	22	52	45	37	30	27	19
13	21	34	44	54	29	39	18	29
15	16	45	41	60	26	46	14	37
17	7	52	36	65	20	50	7	44
19	2	56	33	67	17	53	3	46
21	5	52	35	65	19	50	5	44
23	12	44	28	60	33	46	11	37
25	21	34	44	54	29	39	18	29
27	31	24	51	46	35	31	25	21
29	41	14	57	40	42	25	34	14
31	51	9	65	36	49	22	42	9

Phases of the Moon.—Full Moon, 7th July, 10.33 p.m.; Last Quarter, 14th July, 1.42 p.m.; New Moon, 22nd July, 9.30 a.m.; First Quarter, 30th July, 11.51 a.m.

On 15th July the Sun will rise and set about 25 degrees north of true east and true west respectively, and on the 12th and 27th the Moon will rise and set approximately at true east and true west respectively. On the 3rd the earth will reach that portion of its orbit at which it will be farthest from the Sun.

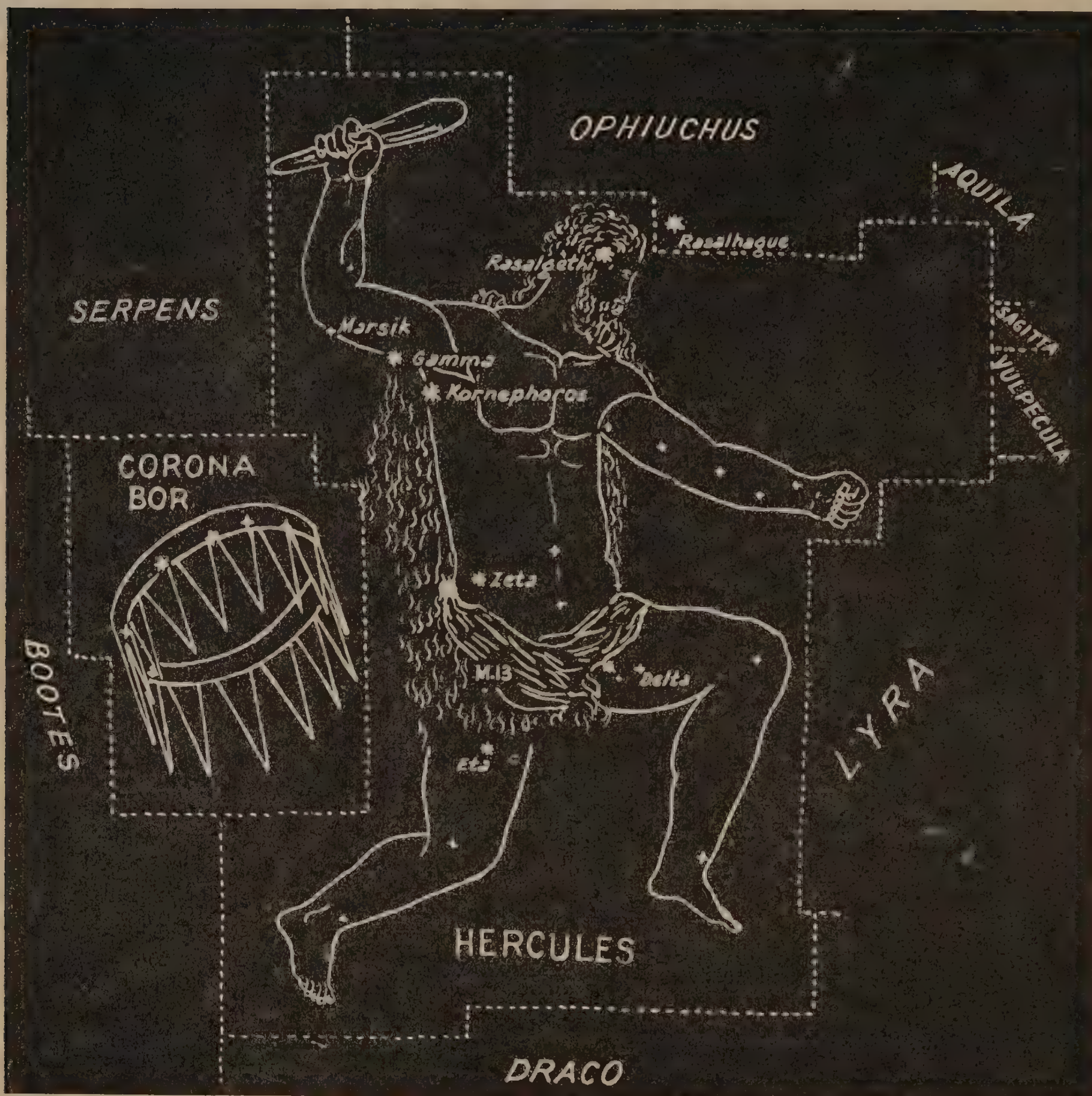
Mercury.—An evening object all this month. At the beginning, in the constellation of Cancer, it will set 1 hour 39 minutes after the Sun and by the 15th, when it will be at its greatest angle from the Sun, it will set 2 hours after sunset. By the end of the month, in the constellation of Leo, it will set 1½ hours after the Sun.

Venus.—At the beginning of the month will be too close to the Sun to be seen, but by the end of July, in the constellation of Leo, it may be observed low in the western sky about sunset, when it will set about ¾ hour after the Sun.

Mars.—At the beginning of the month, in the constellation of Virgo, will set between 1.45 a.m. and 3 a.m., and by the end of the month, in the constellation of Libra, it will set about midnight.

Jupiter.—In the constellation of Aries, will rise between 2.15 a.m. and 3.30 a.m. on the 1st and near midnight at the end of the month. The Moon will be close on the 16th.

Saturn.—In the constellation of Virgo, will set from 1 to 2 hours before midnight during the month. The Moon will be close on the 28th.



THE CONSTELLATIONS.

HERCULES.

This is a large constellation stretching from declination 50 degrees north to just north of the Celestial Equator and placed east of the constellation of Bootes (described last month). The group is named after the famous fabulously strong hero of mythology who successfully accomplished the twelve labours set by Eurystheus, King of Mycenae. Alpha, the brightest star of the group, is known as Rasalgeti or Ras Algethi and is a fine telescopic double separated by 4.4 seconds of arc. The brighter star of the pair is orange in colour and is an irregular variable with an average period of 88 days. The other star is green in colour. Beta is known as Korrephoros and Kappa as Marsik. Gamma is a double star with a separation of 40 seconds of arc, and Delta, also a double, is separated by eleven seconds of arc. About a third of the way from Eta to Zeta is the famous Globular Cluster M 13, which is considered second only to Omega Centauri; it is not well seen from our latitudes. It was discovered by Halley in 1716. In the northern hemisphere, when its position is known, it can be seen as a hazy 6th magnitude star on moonless nights.

CORONA BOREALIS (The Northern Crown).

Another semi-circle of stars but much more conspicuous than Corona Australis. Corona Borealis lies between Bootes and Hercules and contains many interesting stars. T Corona Borealis seems to be a recurrent Nova. In 1866 this star rose suddenly from 9th magnitude to 2nd magnitude; nine days later it became invisible to the naked eye and after several fluctuations it settled down again to 9.5 magnitude; but in 1946 it staged a similar outburst, which was well observed by astronomers all over the world: R Corona Borealis is an irregular variable which usually remains at a maximum of about 5.8 magnitude for several years and then falls relatively rapidly to a minimum of about 12.5 magnitude. The duration of this minimum varies considerably and it may be a few months or several years before this star regains normal brightness.

Supplement to the "Queensland Agricultural Journal," February, 1953.

Volume 75

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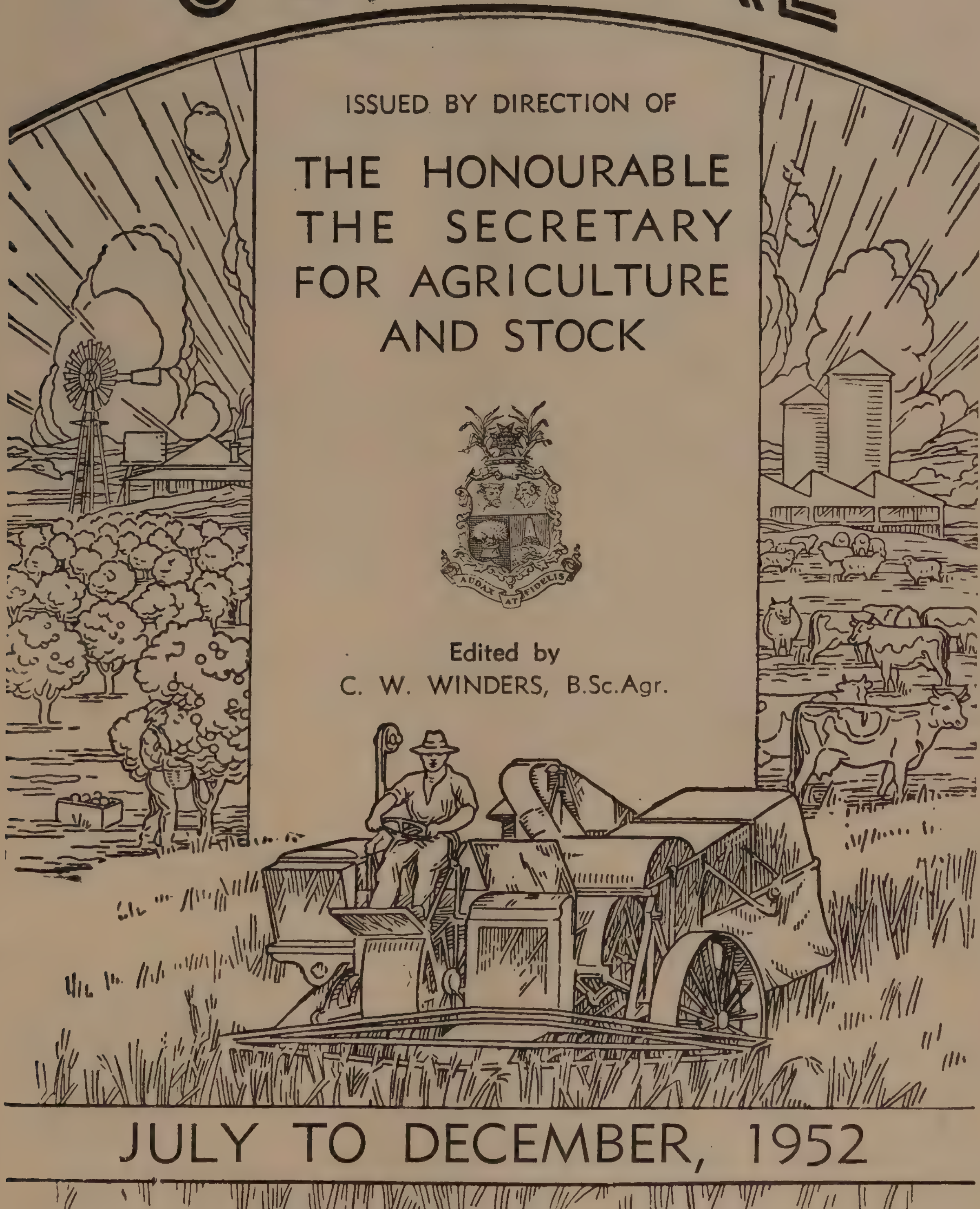

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AUDAX AT FIDELIS

Edited by
C. W. WINDERS, B.Sc.Agr.

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AUDAX AT FIDELIS

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Irrigated Lucerne Crop, Boyne Valley.

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Spica—A New Wheat Variety
The Plum
The Apricot
Nut Crops
Birdsville Disease of Horses
Animal Protein Factor in Pig Rations
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ROMA STREET . . . . BRISBANE

Spica—A New Wheat Variety.

D. ROSSER, Assistant Plant Breeder, Agriculture Branch.

SINCE the establishment of a Regional Experiment Station at Hermitage, portion of the wheat improvement programme conducted by the Department of Agriculture and Stock has been concentrated on testing a large number of selections from crosses made previously. One of the first results of this work was the naming and registration of Lawrence, and its recommendation as a dual-purpose wheat (*Queensland Agricultural Journal*, January, 1951). The latest outcome has been the liberation of a new grain variety to be known as Spica.

While Lawrence is a slow-maturing variety suitable for early sowing and feeding-off, Spica is in the quick-maturing class and is intended for main-season or late sowing for grain production. Its rust resistance, coupled with its high yielding ability and satisfactory baking quality, should make it a valuable and popular addition to the range of Queensland wheat varieties.

History of the Variety.

The new variety was developed from crosses made by Mr. R. E. Soutter at the former Roma State Farm. The final cross was made in 1934 between an unfixed hybrid (Three Seas x Kamburico) and an unnamed hybrid selection (Pusa x Flora 3202).

Fixed selections from this cross entered field tests in 1946, and TS.K.PF.-4601 was the designation given to the first of these selections. This selection performed well in its initial yield test, which was a plant breeder's strain trial laid down at Hermitage in 1947. Since then it has maintained an excellent record in larger field trials and in increase plantings which were sown in 1951 in anticipation of its release for general cultivation during the current season.

Name of the New Variety.

This selection (TS.K.PF-4601) has now been registered with the Registrar of Cereal Varieties in Australia under the name of Spica (pronounced to rhyme with "mica").

The reason for using this name for the new variety may be of interest. The brightest star in the constellation of Virgo has the name Spica, derived from a Greek word meaning an ear of grain. The Latin word *spica* also means an ear of grain. The origin of the word and the suggestion of the spiky nature of the heads of the new variety, combine to make Spica an appropriate name for it.

Plate 1.

Spica Wheat: Heads and Grain. (Approximately natural size.)

Description of the Plant.

In the early stages, growth is fairly erect but somewhat weak. The leaves droop and can be identified by a slight silvery appearance due to a profusion of very fine hairs on both surfaces. This extreme downiness of the leaf blades and the lack of hair on the auricles are characters which it shares with Hofed, a variety not widely grown in this State.

The ripe straw is pale yellow in colour and mid-tall in height, averaging about two inches taller than Puora. It is hollow in structure, and, although fairly slender, is of satisfactory strength for normal Queensland conditions.

The type of ear and grain is illustrated in Plate 1. The ear is prominently awned, of medium size, tapered, and slightly inclined. The chaff is smooth and pale yellow when ripe. The ear bears a superficial resemblance to Three Seas, one of its parents. Most growers will be familiar with the fact that Three Seas is liable to shed grain at maturity. The new variety differs from its parent in showing no signs of shattering. Under the wide range of seasonal conditions experienced between 1947 and 1951, Spica was never observed to shed its grain. Although the ears hold the grain very firmly, threshing is not difficult.

The grain is large, amber-coloured, semi-vitreous, and of good bushel weight; it is somewhat angular and irregular in shape. Grain samples from Hermitage Regional Experiment Station in 1951 proved to be 12 per cent. larger than those of Puora grown under the same conditions. The number of grains per ounce for each of the varieties Spica, Puora and Gabo grown in the one trial area was as follows:—Spica, 665; Puora, 744; Gabo, 790.

The variety is in the quick-maturing group, being normally about two days later than Puora in heading and maturity.

Flour Quality.

Initial quality tests carried out on the grain of this variety indicated that it was a wheat of good gluten strength, which should be eminently suited for bread-making purposes. More detailed tests conducted during the last three years have placed it in the "strong" or "medium-strong" wheat class, according to the conditions under which it was grown. While not possessing the extreme gluten strength of Pusa-4 and some other premium wheats, its flour provides an elastic and well balanced dough of a type considered to be well suited to modern baking requirements.

Rust Resistance.

One of the important features of this variety is its resistance to stem rust under field conditions. To date, the variety has been practically immune to attack by stem rust in the mature plant stage. This resistance was unaffected by the advent of new races of stem rust which became prevalent during the 1949-50 season, and which proved capable of attacking such hitherto resistant varieties as Yalta, Kendee, Charter and Gabo.

Spica also shows some resistance to leaf rust. While it is seldom completely free from leaf rust pustules, its reaction to this disease is superior to that of many other varieties in commercial cultivation.

Plate 2.

Spica Wheat: Seed Increase Plot at Hermitage Regional Experiment Station.
Sown 26/6/51; harvested 22/11/51; yield 54 bu.p.ac.

Plate 3.

Spica Wheat: Harvesting of Seed Increase Plot, Hermitage Regional Experiment Station, November, 1951.

Yielding Ability.

During the past three years, Spica has been tested against all the best available varieties in its own maturity class (that is, the quick-maturing group which includes such popular varieties as Gabo, Puora and Seafoam). The detailed testing in these varietal trials followed two years in smaller strain trails. In all such trials the new variety yielded well. One of the significant results of these tests was that its yield performance was equally impressive in the very wet year of 1950 and in the dry season of 1951. Its uniformly high position in the yield tables over the last five years indicates a very promising degree of adaptability.

Based upon the results of such trials, Spica is expected to yield at least as well as Gabo, and to show a considerable improvement over other early maturing varieties such as Puora. A summary of varietal yields in comparison with Gabo and Puora is given in Table 1.

TABLE 1.

MEAN YIELDS OF SPICA IN COMPARISON WITH TWO STANDARD VARIETIES.
(Yields in bushels (60 lb.) per acre.).

Planted.	Site.	Spica.	Gabo.	Puora.
June, 1947	Hermitage	61·9	60·2	..
July, 1948	Hermitage	44·5	48·2	40·9
June, 1949	Hermitage	48·7	51·1	41·2
August, 1950	Hermitage	38·5	22·6	15·4
June, 1950	Evanslea	26·6	20·0	19·7
June, 1951	Hermitage	57·8	67·2	50·2
June, 1951	Evanslea	36·8	38·1	28·9
June, 1951	Biloela	32·3	30·3	28·9

Spica Recommended as Grain Wheat.

Spica is recommended to replace Puora, Seafoam and similar rust-susceptible varieties in main-season and late plantings. It is unsuitable for hay on account of its awns and a tendency to lodge when conditions favour heavy growth. In addition, its quick maturity and liability to frost damage when sown early make it unsuitable as a dual-purpose (grazing plus grain) variety. However, its resistance to rust and shattering, together with its capacity to produce high yields under a wide range of conditions, should make it a very useful wheat variety for grain production in Queensland.

Is This a New Strain of Townsville Lucerne?

THE potential value of selection work within existing pasture species is shown by the appearance of what seems to be a superior type of Townsville lucerne (*Stylosanthes sundaica*), an annual leguminous plant.

In the summer of 1949-50, officers of the Department of Agriculture and Stock located a small stand of Townsville lucerne growing on infertile granitic sand near Dayboro, about 30 miles from Brisbane. Seed was harvested from these plants, which in subsequent seasons have continued to regenerate from self-sown seed.

Dayboro would normally be considered too far south for successful growth of this legume, and so far it has not been observed growing in competition with grasses in this district. The plants from which the seed was harvested had no competition and exhibited the customary prostrate habit which is a feature of Townsville lucerne and which seems to restrict its development in densely grassed country.

The seed collected was sown during 1950 in small broadcast plots on forest country in the Bundaberg agricultural district, and seed from commercial stocks of Townsville lucerne was also planted for comparison. Germination was good in both plots.

Neither plot was cleaned of volunteer plants, in order that the ability of the strains to withstand competition could be judged. A difference between the two plots was soon apparent. The plants grown from commercial seed had the normal prostrate habit and made best growth where invasion by local grasses was least. On the other hand, the plants grown from the Dayboro seed showed their ability to compete with grass by assuming an upright habit and spreading fairly evenly over the plot.

Both plots seeded in the autumn and regenerated from seed in the summer of 1951-52. Once more the plants from the Dayboro seed showed an upright habit. Furthermore, this strain was observed to be spreading through neighbouring grassland and competing actively with other tall-growing, vigorous pasture species. The plants on the commercial seed plot were again prostrate and the best plants occurred on areas free of grass.

Heavy seed setting occurred during the autumn of 1952, and as much seed as possible will be harvested. This will be reserved for further official testing, for it is important to determine whether this type will stand up to stocking and mowing, in which case it will have advantages over the prostrate form for pasture use.

Advice on Fertilizers and Soils.

Farmers are reminded by the Division of Plant Industry that inquiries on soil treatment should normally be directed to the Adviser in Agriculture or Adviser in Horticulture stationed in the district concerned. If there is no easily accessible local officer, a letter of inquiry, setting out the problem involved, should be sent to the Under Secretary, Department of Agriculture and Stock, Brisbane.

Soil samples should not be sent with the inquiry. The Department has sufficient information on soil types and their fertilizer requirements to enable it to deal with most inquiries without first making a soil analysis. Should a soil analysis be considered necessary by the Department, the farmer will be notified to that effect and supplied with directions on the size of the sample required and the method of taking it.

The Plum.

K. M. WARD, Senior Horticulturist.

THE several groups of plums have originated in widely separated countries. The European plums (*Prunus domestica,* family *Rosaceae*) are probably native to an area near the Caspian and Black Seas and may be derived from natural crosses between two wild species, the European sloe (*P. spinosa*) and the Myrobalan plum (*P. cerasifera*). The so-called Japanese plums (*P. salicina*) are thought to be native to China and were introduced into Japan about 1500 A.D. Many commercial varieties of this species were produced in America from seedlings and hybrids. Two other groups of less economic importance are the damson plum (*P. insititia*) and the native American plums (*P. americana, P. nigra,* and others).

Both European and Japanese varieties of plums have been grown in Queensland for approximately 40 years, commercial production being confined in the main to the Stanthorpe district. The annual State production is 140,000 half-bushels, which is almost wholly sold on the fresh fruit market in Queensland and southern States.

CHARACTERISTICS OF THE PLUM TREE.

Annual Growth Cycle.

Dormant period	April to August
Blossoming	Late August to late September
Shoot growth	September to February
Harvesting	Early December to early February
Fruit bud initiation	January and February

Flowering and Fruiting Characteristics.

The flowering and fruiting habits of European and Japanese plums are quite different.

In the European plum, the one-year-old shoot carries only vegetative buds (Plate 4, A, 1) and terminates in a leaf bud. In the next year, buds on the previous year's wood develop into short spurs, often referred to as stubs, which carry both flower and leaf buds (Plate 4, B, s); and the current year's shoot growth bears leaf buds only. In the third year, fruit is produced on the three-year-old wood (Plate 4, C, x), spurs are formed on the two-year-old wood, and only leaf buds are formed on the current year's growth. All flowers are borne

laterally. Flower buds of European plums usually contain one or two, but sometimes three, flowers, and in different varieties these may open before, with or after the leaves. The flowers are less numerous than in the Japanese varieties.

Plate 4.

Fruit-bearing Wood of European Plum. A—shoot growth at end of 1st growing season; B—shoot growth at end of 2nd growing season carrying fruiting bud (f) on spurs or stubs (s); C—shoot growth at end of 3rd growing season—fruit was borne at x, and shoot is no longer fruitful.

The Japanese plums bear fruit on one-year-old wood as well as on older wood (Plate 5). The flower clusters each contain three or more flowers, and because of this habit, Japanese plums are commonly used for ornamental purposes. Flowers are also borne on spurs which develop from latent buds on the branches of mature trees.

Fruiting spurs on both European and Japanese trees lengthen and bear fruit for a number of years before becoming unproductive. Flowering is so profuse that a setting of 1 per cent. or less is normally adequate for a satisfactory crop. Setting is usually heavier in Japanese than in European varieties.

VARIETIES.

The two principal commercial groups of plums, European and Japanese, can be separated from each other without difficulty.

European plum trees have dull green, serrated leaves which are relatively thick, wrinkled on the surface, thinly hairy to hairy on the

Plate 5.

Fruit-bearing Wood of Japanese Plum. A—1st season shoot bearing leaf (l) and flower buds (f); B—2nd year shoots bearing flower buds (f) and spurs (s), and a fruit stalk (x); C—3rd year shoot which has borne fruit at x and is now barren.

upper side and covered with soft hairs beneath. The fruit is commonly bluish-purple but some varieties are yellow, red or green. The group includes the many varieties which are known as prunes.

Japanese varieties have leaves with a relatively smooth, shiny upper surface, and a smooth dull surface beneath. The fruit is rarely purplish, but commonly yellow or red in colour, and usually pointed at the apex, though a number of varieties are rounded.

Damson plums are noted for their tartness and are used mainly for jellies and jams.

Native American plums are of little economic importance. One of them, the *Chickasaw,* is occasionally grown here and it is apparently fairly well adapted to sub-tropical conditions.

The Myrobalan or cherry plum is of interest only as a rootstock for plum and other stone fruits, particularly in heavy types of soils.

European Varieties.

Angelina Burdett.—The fruit is of medium size, ovate and somewhat asymmetrical with a deep suture; skin colour is dark purple with small brown spots and a heavy bloom. It is suitable for culinary, dessert and drying purposes. The tree is vigorous, hardy and productive when suitably pollinated. The crop ripens during late December and early January.

Grand Duke.—The fruit is oval, deep purple in colour, with a firm, golden-yellow flesh. The tree bears well and matures its crop about mid-February.

President.—The fruit is similar to that of *Grand Duke* in appearance and quality, but the tree is not such a prolific bearer. The crop ripens during February.

Coe's Golden Drop.—An excellent variety for culinary purposes. The fruit is oval in shape, golden-yellow in colour, occasionally with a faint bronze blush and usually showing greenish streaks during the maturing period; the flesh is yellow, firm and juicy. Fruit size ranges up to two inches in length. It matures during February.

Pond's Seedling.—The fruit is not as good as that of most other European varieties; it is golden-yellow in colour, not very juicy and the flesh tends to be coarse and fibrous. The crop ripens during February.

Black Diamond.—A plum which lacks both flavour and juice; the colour is purplish-black with many small russet spots and a heavy bloom. The fruit carries well and makes good jam. The tree is vigorous and yields heavy crops. The crop matures from late December to early January.

Japanese Varieties.

Wilson.—A round, medium-sized plum, red in colour, juicy, and suitable for dessert and culinary purposes. The tree is vigorous and sets heavy crops often with little cross-pollination. It is one of the earliest varieties and matures its fruit during December.

Burbank.—A globular fruit which is red in colour, dotted with yellowish spots and possesses good flavour. Its transport qualities are good. Primarily a dessert variety of little value for jams or canning. The crop matures from late December to January.

Santa Rosa.—The fruit is large, oval and purplish-crimson with a dark red flush; a good dessert quality plum which carries well. The variety ripens during January.

Shiro.—A fairly large, yellow plum with an almost semi-transparent flesh. The tree is a heavy bearer and matures its crop during early January.

October Purple.—A large, heart shaped, dark-purple plum with firm, juicy yellow flesh of good quality. Yields are good. The crop matures in the latter half of January and early February.

Narrabeen.—A large, rounded, reddish plum with yellow dots and a yellow flesh; juice and flavour make it a dessert quality variety. The tree bears crops which mature during January and early February.

Satsuma.—Often referred to as the "blood plum" because of its purplish-red coloured flesh; a large dark-red plum which is best suited for jams and other culinary uses.

POLLINATION.

The European plum varieties grown in Queensland are very largely self-incompatible and will not, therefore, bear satisfactory crops unless cross-pollinated. Consequently, in planting out an orchard, provision must be made for the interplanting of cross-compatible varieties. Angelina and Coe's Golden Drop are notoriously poor bearers when planted alone. Angelina can be interplanted with President, Grand Duke, Black Diamond, and Pond's Seedling. All of these varieties flower at approximately the same time, and, as they are cross-compatible, they may successfully be interplanted with each other. Coe's Golden Drop flowers later and should, therefore, be interplanted with Green Gage, President or Grand Duke, the flowering periods of which overlap that of Golden Drop.

European and Japanese plums do not effectively pollinate each other, except in a few cases of minor importance. Most Japanese varieties, like the European, are largely self-incompatible and the best crops are set when different varieties are interplanted. The several varieties commonly grown at Stanthorpe can be interplanted provided the flowering periods overlap sufficiently. Wilson and Santa Rosa varieties show a moderate degree of self-fruitfulness and may set satisfactory crops even in the absence of cross pollination.

CLIMATIC REQUIREMENTS.

Plum trees rank next to the apple in winter hardiness and are generally less subject to low temperature injury than the peach or apricot. There is a considerable variation in the cold-hardiness of different varieties. The buds of the Japanese plums are usually less hardy than those of the European, but the open flowers of Japanese plums are more resistant to cold than those of either European plums or apples.

The winter chilling requirements of the plum are less than those of the apple, and in the Stanthorpe district the trees flower three to four weeks earlier. Japanese varieties require less chilling than European; they therefore set somewhat earlier and usually set better crops following a warm winter. Plum trees need a winter period of two months or more during which the average temperature is 48 deg. F. or less. In localities where winter chilling is inadequate, the flower and leaf buds are slow to open, bud shedding is common and the fruit matures late. Some varieties are more suited to warm localities than others.

Early flowering is undesirable in the Stanthorpe district because of the risk of blossom injury from late frosts. Dangerous atmospheric temperatures during blossoming and fruit setting range from 28 deg. to 31 deg. F.

Plums require a moderate annual rainfall of 30-35 inches which is well distributed through the growing season. Moist atmospheric conditions during the ripening of the fruit are, however, undesirable because they favour the development of brown rot.

SOIL REQUIREMENTS.

Plum trees grow satisfactorily on soils ranging from fertile clay loams to light granitic sandy loams. In general, European varieties grow best on loams and clay loams, while Japanese plums show a preference for lighter soils. The suitability or otherwise of the different soil types for plums is to some extent bound up with the type of rootstock used. Trees on Myrobalan roots are better adapted to rather heavy soils than most other deciduous fruits. Nevertheless, the best root development takes place in soils with good drainage and aeration.

The optimum soil reaction for plums lies between pH 5.5 and 6.5. As with other fruit trees, plums live longer and yield better on the more fertile soil types. The most suitable Stanthorpe soils are the deeper alluvials with a relatively heavy subsoil.

PROPAGATION AND ROOTSTOCKS.

Both European and Japanese plums are propagated by nursery budding on various rootstocks. The most widely used stock in many districts is the Myrobalan plum, which is compatible with most cultivated varieties and usually produces a very vigorous tree. This stock is adapted to a wide range of soils and shows a fair tolerance to poor drainage. In districts with a light soil, plums are frequently worked on peach stocks, some of which are resistant to nematode attacks. At Stanthorpe, peach stocks are commonly used. However, Myrobalan stocks are preferable on the heavier soils.

Marianna, a variety of the Myrobalan plum, has been used as a plum rootstock, partly because it can be propagated by cuttings, and partly because of its resistance to nematodes. It is less tolerant of heavy soils than the Myrobalan and also less drought resistant; it is not a good stock at Stanthorpe. Apricot and almond stocks have also been used as rootstocks for plums but the results have not been satisfactory.

Problems of incompatibility between certain European plum varieties (for example, prunes) and peach stocks can be overcome by double working. This involves budding a compatible plum on a peach root, and then working the desired variety on to the intermediate stock.

PRUNING.

The Non-bearing Tree.

Early pruning of the plum tree is designed to force the development of scaffold branches which are strong enough and numerous enough to carry heavy crops of fruit. This can be achieved by cutting back the main shoots hard in the first few years, so that the tree has 12 to 20 secondary scaffold branches when it reaches maturity. The main scaffold branches should possess wide crotch angles and join the trunk at different levels.

The Bearing Tree.

The principal reasons for pruning bearing plum trees are (1) to thin out excess fruiting wood and thus control fruit size and numbers, and (2) to control growth so that all parts of the tree receive sufficient sunlight and are accessible for spraying, thinning, harvesting and other operations (Plate 6). Fruiting wood is produced very freely on the plum tree and it is therefore a simple matter to provide a well distributed supply of two-year-old fruiting spur wood and one-year-old renewal wood each year.

Plate 6.

A Well Formed Plum Tree in the Early Bearing Stage of its Life.

Treatment of Terminal Shoots.

When a tree is approaching or has reached maturity, terminal shoots can be induced to produce fruiting wood either by leaving them unpruned or by pruning them lightly. The setting of fruit on the terminal shoots will greatly reduce leader growth and tend to stabilise the size of the tree. Subsequently, terminal growth will require only light pruning.

Treatment of Laterals.

The laterals or spur-bearing shoots which bear most of the fruit are distributed over the whole of the tree. Unless thinning is necessary to ensure reasonable fruit size, these shoots are left unpruned until after the crop is harvested. They are then cut out to make room for renewal wood which will bear the next season's crop.

Treatment of Spurs.

Fruiting spurs, as distinct from spur-bearing laterals, may attain lengths ranging up to 12 inches. They bear fruit for a number of years and should be retained until they begin to lose their fruitfulness, when they are cut back to force new growth.

Plate 7.

A Top-worked Plum Tree. Wilson plum strap-grafted on Narrabeen, showing one season's growth.

Summer Pruning.

In young trees, excessively vigorous shoots should be cut or pinched back at the tip to hasten the development of other shoots required for scaffold branches. This is done early in the growing season. At the same time, unwanted shoots can be removed and others tied into suitable positions.

RE-WORKING.

Plum trees can be re-worked to another variety but the operation should be restricted to healthy trees. Two methods are commonly used; in both of these the tree is first deheaded or cut back to within one to two feet of the trunk. Scions of the desired variety can then be worked on the stumps by means of a suitable graft such as the strap graft (Plate 7). Alternatively, buds may be worked onto selected shoots

which arise from the stumps during the next growing season. The first of these two methods is preferred at Stanthorpe, where the wounds heal quickly and the grafted scions rapidly develop into new branches.

European varieties can be top-worked with buds from both Japanese and European plums. Japanese varieties, however, must be top-worked only with Japanese buds; takes with European buds are seldom good. In general, it is best to work European varieties onto European rootstocks, and to confine Japanese varieties to Japanese rootstocks. European plums, but not Japanese, may be top-worked with apricots.

TREE NUTRITION AND ORCHARD MANAGEMENT.

Efficient soil management is just as necessary in the plum as in the apple orchard at Stanthorpe. Winter green manure crops, stimulated where necessary by artificial fertilizers, and supplemented where practicable with other forms of organic matter, greatly assist in developing fertile soil conditions.

The plum responds fairly rapidly to nitrogenous fertilizers, though not so quickly as the peach and apricot. Young trees require fairly large amounts of nitrogen, but later on, complete fertilizer mixtures containing nitrogen, phosphoric acid and potash will probably be needed on all but the most fertile soils. Liberal supplies of nitrogen are required in early spring to assist in fruit setting, and this dressing appears to increase the resistance of the trees to frost injury. Where a green manure crop is turned in during late winter, a nitrogenous fertilizer may be required to offset the temporary demand made on this element by the decomposing crop. In addition to the green manurial treatment, the following fertilizer programme should be followed in Stanthorpe orchards:—

(i.) *Young trees up to* 8 *years of age.*—Late winter (August)—Sulphate of ammonia, ¼ lb. to ½ lb. for each year of age of the tree; thus, 6-year-old trees would receive 1½ to 3 lb. per tree.

Mid-spring (October)—5-13-5 mixture, ½ lb. for each year of age of tree.

(ii.) *Mature trees.*—Late winter—8-12-4 mixture, ½ lb. for each year of age of tree, with a maximum of 10 lb. per tree.

Mid-spring—5-13-5 mixture at same rate.

In both cases, the late winter application should be made when the green manure crop is turned in or shortly afterwards, and spread over most of the root area of the trees.

Plum trees rarely show symptoms of zinc deficiency (little-leaf), even when apple trees in the same soil type are severely affected by the disorder. Treatment with zinc sulphate sprays is apparently rarely necessary in the Stanthorpe area.

CROP THINNING.

Thinning of the crop by hand is a recognised practice in plum orchards and is beneficial even where severe pruning is done to reduce fruiting. Thinning improves the size, quality and colour of the fruit, and thus helps to meet the market demand for large attractive plums. Thinning also reduces the adverse effect of overcropping and minimises the breakage of fruiting branches.

The amount of fruit removed depends on the vigour of the tree, the variety and the method of pruning, but a fruit spacing of from two to four inches is usually adequate for Japanese varieties. As European plums will size up in clusters, they require less thinning than Japanese plums and may often be left unthinned. Fruit in the interior and lower portions of the tree, which are heavily shaded, are likely to be poor in colour and should be severely thinned. Wilson, Burbank and some other varieties usually require heavy thinning, but a number of varieties tend to thin their crops naturally and require only light thinning.

The most appropriate time for thinning is immediately after the natural shedding of fruit has taken place, usually in late spring. Excessive cropping is associated with small fruit size in the current crop and may affect fruit bud formation for the next season's crop; early thinning is therefore essential.

Thinning is most commonly carried out by hand. Other methods include the jarring of branches with a short length of rubber hose, and brushing the flower clusters with a loose broom or switch made of twigs, but both are unsatisfactory after the pit of the fruit has commenced to harden. Dinitro-ortho-cresylic acid and other blossom- thinning sprays have given mixed results and are seldom used here.

HARVESTING.

Plums of good dessert quality should be picked as near to full maturity as practicable, consignments for distant markets being picked a little earlier that those for near markets. For a period ranging from one to several weeks before full maturity, plums undergo distinct changes of colour. In Japanese and light-coloured varieties, the first marked change in skin colour is from green to yellowish-green, and this is followed by more definite yellowing, after which the fruit assumes its characteristic red or yellow colour. Blue or purple varieties change from green to greenish-blue or reddish-purple followed by dark blue or purple. Development of full colour is accompanied by a softening of the flesh, commonly beginning at the end of the fruit opposite the stem, and fruit is frequently picked for local markets at this stage. Because plums gain rapidly in weight, size, sugar content and flavour during the later stages of ripening, it is advantageous to harvest as late as possible. Once the fruit has been picked it gains little in sugar content, and ripening then consists in a softening of the flesh and a deepening of skin colour.

Experience is needed to decide when the harvesting stage has been reached, as from year to year plums may show variations in the ripening period. The most important factor determining the ripening date is the temperature during the growing season; high temperatures advance the date, low temperatures delay it.

Since the fruit does not ripen uniformly on the tree, several pickings are made. As the season advances, fruit may be picked with slightly less colour and a little firmer.

Plums are highly perishable and must therefore be handled with great care. Stems should be retained on the fruit as far as practicable, the flesh must be unbruised and the skin left intact with the bloom disturbed as little as possible.

The Apricot.

M. A. HANNIGAN, Senior Adviser in Horticulture.

THERE appears to be some doubt as to whether the apricot (*Prunus armeniaca*, family *Rosaceae*) is a native of Armenia or of Western China. The botanical name suggests that the plant originated in Armenia, although it was known to the Chinese more than 2,000 years ago.

In Queensland, the Granite Belt and Warwick districts are the only areas where apricots are grown commercially. The apricot is, however, not particularly well suited to climatic conditions in the Granite Belt and annual production has remained at approximately 20,000 half-bushel cases for the past decade. The whole crop is sold on the fresh fruit market.

GROWTH AND FRUITING HABITS.

The flower buds are borne either singly or in pairs on one-year-old lateral wood and on short spurs on the older wood (Plate 8). Spur development is greater in apricot than in peach trees.

The leaf and flower buds of the apricot require less winter chilling than most other stone fruits but the tree has a pronounced tendency to shed flower buds after a warm winter. In the Stanthorpe district, the trees blossom from the middle to the end of August; at Warwick, on the southern fringe of the Darling Downs, about three weeks earlier.

VARIETIES.

Only a limited number of varieties have proved suitable for the climatic and soil conditions in Queensland. The most widely grown are as listed.

Granite Belt:—

Newcastle.—An early maturing variety which bears heavy crops; the fruit is rather small and of indifferent quality.

Trevatt.—A popular mid-season variety which usually matures its crop in mid-December; it is a fairly consistent bearer, and ripens its fruit evenly.

Moorpark.—A mid-season variety with fairly large fruit of good quality; the two sides ripen unevenly and the variety is therefore unsuitable for canning or drying; the trees are not consistent croppers.

Tilton.—A late variety with relatively large fruit of good quality.

Oullins, an early strain, and *Mansfield Seedling* are other varieties of commercial interest.

Southern Darling Downs:—

Glengarrie.—An early variety that matures its fruit about the end of October; it blossoms at the end of July and is therefore subject to frost damage.

Newcastle and Moorpark are also grown in this area.

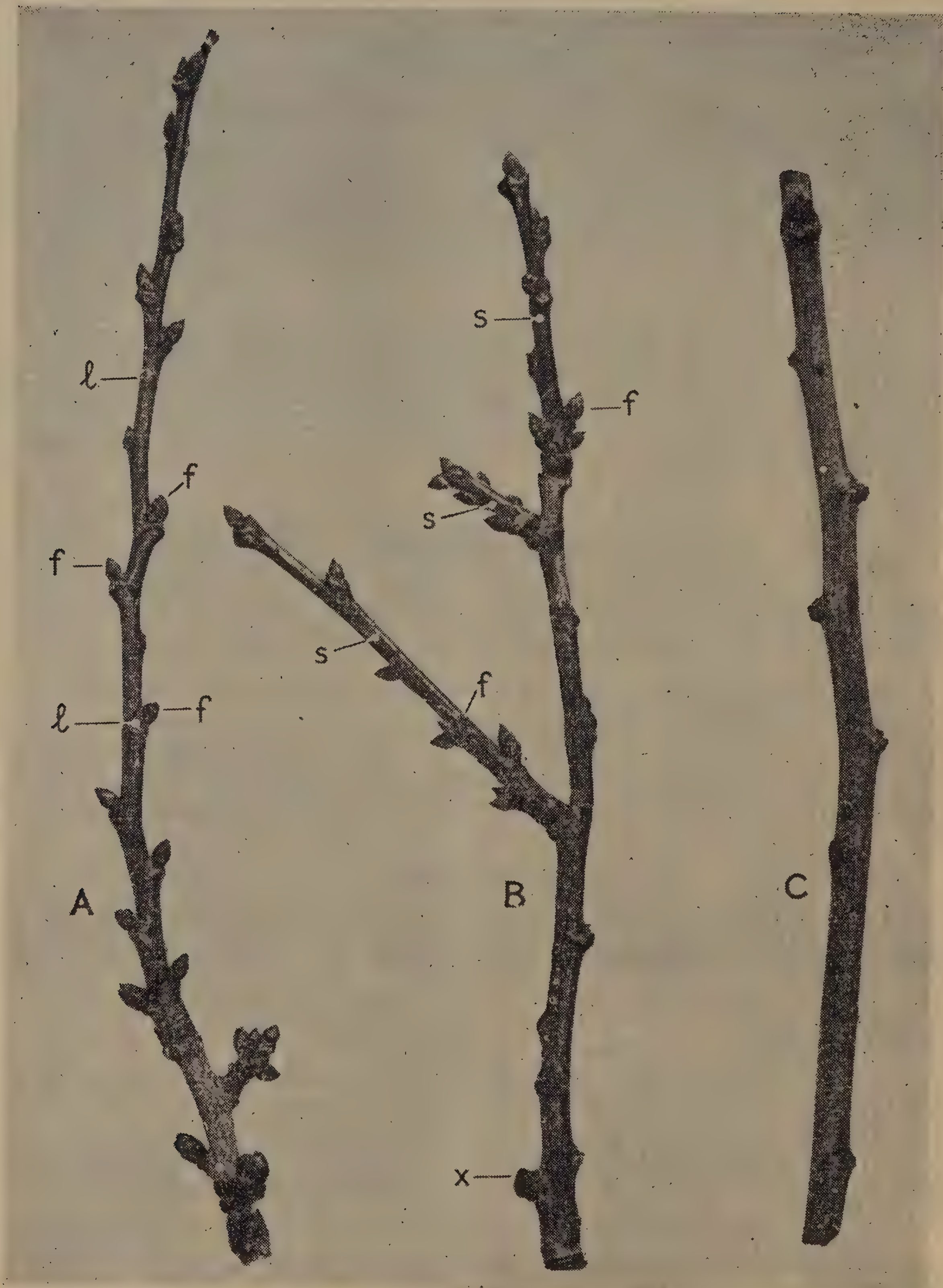

Plate 8.

Fruit Bearing Wood of the Apricot. A—at end of 1st growing season, bearing flower (f) and leaf (l) buds; B—at end of 2nd growing season; fruit was borne at x, two side buds and the terminal bud produced short shoots (s) bearing flower buds; C—2-year-old, unfruitful wood.

SOIL AND CLIMATE REQUIREMENTS.

Apricots can be grown in soil types ranging from light sandy loams to heavy loams, but good natural drainage is essential. Shallow soils overlying an impervious clay subsoil, and therefore subject to waterlogging, are unsuitable for the crop. The heavier soils south and

south-west from Warwick produce larger trees than the granitic sandy loams at Stanthorpe. Trees planted in rich alluvials tend to make excessive vegetative growth and usually bear light crops of poor quality fruit.

Well sheltered and warm positions are preferred for the crop, since the tree blossoms earlier than most other stone fruits and is therefore more susceptible to injury from spring frosts.

ROOTSTOCKS.

The three principal rootstocks used for propagating apricot trees are seedling apricot, peach and the Myrobalan plum. The type of soil in which the trees are to be planted largely governs the stock used. On deep sandy loams, the seedling apricot or peach stock is preferred; on heavier soils which are inclined to be wet, trees worked on Myrobalan plum stock are longer lived than trees worked on to apricot or peach. Seedling stock trees are budded to the desired variety.

TRAINING AND PRUNING.

During the first five years after planting, the young tree must be equipped with a strong framework so that it can carry a heavy crop of fruit without any limb breakage or splitting. The wood is somewhat brittle and a comparatively short main trunk is therefore essential. The young tree is headed back about 15 inches above ground level after it is planted, the cut being made above a bud. In the following season, three or four evenly spaced branches will develop and each is cut back in the winter to a length of about 15 inches. The cut on each limb should be made above a bud which is so placed that leaders developing from it and the one immediately below will form part of an evenly spaced circle of leaders round the tree. A five-year-old tree should be from seven to nine feet high with six to eight leaders. From then on, pruning consists in thinning out the fruiting wood to balance the size of the crop with the vigour of the tree.

The apricot bears its fruit on one-year-old wood and on the spurs of the leaders and main arms. All laterals should be tipped if they are longer than 10 inches, while long laterals on the inside of the tree are cut back to one-third of their length. Fruit spurs on the shortened laterals generally remain fruitful for about three years. At this age, they are cut off where they join the main stem or leaders. Vigorous and unfruitful laterals are also completely removed. Renewal wood develops at the base in both cases and the fruit is therefore carried close to the main limbs and leaders.

Strong laterals near the top of the leaders should be removed. When tipping the leaders, the cut should be made about half an inch above a bud because of the tendency of apricot wood to die back behind the cut. In vigorous trees it is often necessary to prune the leaders back to a suitably placed lateral; the lateral is not tipped.

SUMMER PRUNING.

Summer pruning of the young tree hastens the development of a well shaped tree. All unwanted shoots are removed as they appear in order to admit light to the rest of the tree. After the trees commence to bear, summer pruning is still necessary. When the crop has been harvested, vigorous wood in the centre of the tree and in other positions where it is not wanted should be shortened back to about 10 inches. Late in the summer any shoots competing with the leaders can be cut right back.

The apricot is very subject to attacks by fungi which gain access to the tree through large pruning cuts. These should therefore be painted over with a Bordeaux paste.

CULTIVATION.

The life of the apricot tree as well as its cropping behaviour is mainly determined by the cultural practices adopted in the orchard.

Soils in the Granite Belt are low in organic matter and green manuring is highly desirable in that area. The main crops used are New Zealand blue lupin and Black Winter rye. With the former crop, the orchard is ploughed in late January or early February and a mixture of 1 cwt. of sulphate of ammonia and 1 cwt. of superphosphate per acre (or 2 cwt. of a 4:15:2 mixture) is applied at or a short time before planting the lupin seed in late February. When Black Winter rye is planted, the orchard is ploughed in February and the seed is sown in March after an application of 1½ cwt. of sulphate of ammonia to the acre. The green manure crop is turned under or disced into the soil a few weeks before the trees commence growth in spring.

Ploughing or cultivation of the orchard is necessary in late spring but no further soil treatment is then needed until mid-autumn.

FERTILIZING.

Regular fertilizer applications are needed to improve the fertility of most apricot orchards. In the late winter, an 8:10:8 or similar fertilizer should be broadcast around the trees at the rate of ½ lb. for each year of tree-age, with a maximum of 8 lb. per tree. This fertilizer is often applied when the green manure crop is turned under. An application of a water-soluble fertilizer in November at the rate of ½ lb. per year of age of the tree, with a maximum of 8 lb., is also beneficial; a 5:14:5 mixture is satisfactory.

FRUIT THINNING.

Reduction in the number of fruits can be brought about by pruning and by hand thinning. The apricot tree naturally sheds a proportion of its fruit soon after setting has occurred, and again when the stone is hardening. Thinning may be necessary after this second shedding, and the amount of fruit allowed to remain will depend on the vigour of the tree. In thinning, small fruit is removed and clusters are reduced so that apricots are uniformly spaced over the tree. Thinning during the "final swell" may result in an increase in fruit size. Size of fruit is governed to some extent by its position on the tree; there is a tendency to larger fruit on outer branches than on the inside, shaded limbs.

HARVESTING.

For the fresh fruit market, apricots are allowed to remain on the tree until they are thoroughly ripe, but still firm enough to carry to market. The earliest stage at which the fruit can be picked is after the green colour of the skin has changed to pale yellow or straw; if picked before this change occurs it will not develop full flavour. Because the crop ripens rapidly, harvesting extends over a short period only, and fruit which has matured sufficiently to develop proper flavour must reach the consumer within a few days of picking. It must be handled without bruising. In preparing apricots for market, the fruit must be well graded for size and colour, and suitably packed.

Nut Crops.

A. A. ROSS, Horticulturist.

NUT crops are of little economic importance in Queensland at the present time, and local production supplies only a small proportion of the market demand. Three species—the Macadamia nut, the walnut and the pecan nut—are, however, grown on a limited scale. Of these, the first is an indigenous tree with a great potential for the future, once selected strains are propagated for orchard plantings. The walnut and the pecan nut, on the other hand, are already established in world commerce and production is primarily a matter of finding the right varieties for conditions in this State.

THE MACADAMIA NUT.

The Macadamia nut (*Macadamia ternifolia*, family *Proteaceae*), which is known commonly as "Queensland Nut," "Australian Nut" "Bopple Nut" and "Bush Nut," is native to the coastal rain-forests of south-eastern Queensland. Approximately 300 acres of seedling trees have been planted in the coastal area between Maryborough and the New South Wales border. A typical mature tree is shown in Plate 9. The Macadamia is an edible nut which can be eaten raw or processed. It is highly nutritious and contains between 70 and 80 per cent. of oil, equal in quality to the best olive oil.

Plate 9.
Macadamia Nut Tree. Tree shape is variable, but good types have a dwarf habit of growth.

There are two recognised botanical varieties of *Macadamia*—namely, *ternifolia* and *ternifolia* var. *integrifolia.* While possessing several points in common, these show certain broad differences. The variety *ternifolia* has long, narrow, spiny leaves which are pink or red when young, and pink to light reddish-brown flowers. The leaves of *integrifolia,* on the other hand, are obovate, almost free of spines, and yellowish when young, while the flowers are creamy-yellow. There is a tendency for *integrifolia* to blossom from June through to March and some strains are almost over-bearing; *ternifolia* blossoms between August and October and produces one main crop. However, between these two distinct types there are numerous intermediate forms varying in spininess of leaves (Plate 10), colour of flower, size of nut and thickness of shell.

Plate 10.

Variations in Leaf Type in the Macadamia Nut. Note gradations from the large, spiny ternifolia (left) to the small, smooth integrifolia (right).

Strains selected for vegetative propagation can be grouped according to the type of nut as follows:—

(*a*) Strains with thin-shelled nuts which are particularly suitable for table purposes when sold in the shell. These yield over 40 per cent. by weight of kernel and can be cracked fairly easily.

(*b*) Strains with moderately-sized medium- to thick-shelled nuts (Plate 11), which can be used for both processing and table purposes. The kernel yield is more than 25 per cent. by weight.

(*c*) Strains with a medium- to thick-shelled nut which is too large for processing but likely to meet the requirements of some consumers.

Plate 11.

Clusters of Macadamia Nuts. A medium-shelled strain commonly found in seedling orchards.

Climatic Requirements.

Being native to the rain-forest of southern Queensland, the Macadamia grows best along the coast under conditions of high humidity and comparatively heavy rainfall. It is, however, tolerant of adverse conditions and crops well from North Queensland to Sydney. In inland districts, the tree thrives in some locations but crops are usually lighter than they are near the coast. In general, the trees produce a deep taproot and relatively few lateral roots; they may therefore need the protection of windbreaks in exposed situations. Under orchard conditions, the trees are shapely, robust and more heavily foliaged than they are when growing in the rain-forest. Crop yields seem to be correlated with the spring rainfall.

Soil Requirements.

The Macadamia grows well on a wide range of soils but fails on infertile coastal sands, heavy clays and gravelly ridges. Like most other fruit trees, it yields particularly well on deep, well-drained soils

with a loam or sandy loam texture. Depth and drainage are the principal criteria used in selecting an orchard site. In coastal areas the red basaltic loams and sandy loam alluvial soils carry excellent stands of this nut.

In keeping with present-day methods of orchard management the land must be managed according to the gradient. Slopes steeper than 1 in 25 should be planted on the contour with every precaution to prevent soil erosion. Planting on excessively steep slopes is undesirable.

Propagation.

All existing orchards of Macadamia nuts have been established from seedlings and consequently include numerous tree types. Some of these trees bear up to 200 lb. of nuts annually while others of similar age produce only 10 lb. Many also bear thick-shelled nuts. Such lack of uniformity in plant material is a major handicap to commercial production, and superior types of trees have now been selected as sources of scion material for vegetative propagation. These include thin-shelled, smooth-round and mammoth types of nuts which should meet the demand for both dessert and processing quality kernels.

Rootstocks are readily raised from seed by ordinary nursery systems. (Plate 12.)

Plate 12.

Macadamia Nut Nursery. Both seedling and grafted trees may be raised in nursery rows. Only grafted trees of known parentage should be used for orchard plantings.

Grafting is more difficult in the Macadamia than in most fruit trees, owing to the hardness of the wood, and considerable practice is required before a high percentage of "takes" can be expected. The best results have been achieved when the seedling rootstocks are side wedge grafted with the selected scions. In the side wedge graft, the scion is sharpened to a V or wedge shape at the basal end and inserted into an oblique cut in the stock. The stock is prepared first by making a straight downward

cut into the trunk at an angle of about 30 degrees and approximately two inches above ground level. The cut should be ¾ to 1 inch in length and should not extend beyond the centre of the stock. After the scion is inserted, the graft is tightly bound with raffia and coated with melted paraffin wax. After-care of the graft is similar to that practised in other trees. Budding is usually much less satisfactory than grafting in the Macadamia nut.

Grafting should be carried out at a time when starch accumulation in the wood is at a peak. The starch content of a tree is highest after the fruit has been harvested and before blossoming, but starch accumulation may be induced in scion wood by girdling suitably sized branches three weeks before the scions are cut. When it can be arranged, early spring grafting is likely to produce better results than grafting in autumn.

Preparation of Land and Planting.

The methods of land preparation practised in any other orchard crops can be followed in the case of the Macadamia. Deep initial ploughing is essential.

Spacings adopted in existing orchards vary from 20 to 30 feet, but the widest spacing is the most satisfactory and 30 feet should be allowed between the trees wherever possible. In designing the orchard, varieties with similar characteristics should be kept together to facilitate harvesting, for it is an unwise practice to mix thin-shelled and mammoth nuts together in market consignments.

Spacing may be influenced somewhat by the common practice of growing inter-row crops when the trees are young. Papaws, pineapples, bananas and most vegetables can be successfully raised between the Macadamia trees provided they are removed before they exert any serious competition for moisture and plant foods. These crops supply the farm income until the nuts come into bearing.

The most suitable time for transplanting young trees into the orchard is from February to April, when the natural rainfall is well distributed and ample soil moisture is available. The roots are particularly susceptible to exposure and care is required to avoid desiccation between lifting from the nursery and planting. In planting grafted trees, the union should be kept above ground level and the usual method of tree planting followed. Planting should be immediately followed by watering.

Pruning.

In its early stages the tree is trained to a squat habit with large spreading limbs. The Macadamia has the natural tendency to grow tall. Consequently when the young tree is about 2 ft. 6 in. high, the top should be pinched out to encourage branching; a few evenly spaced limbs are then allowed to develop into a strong, rounded, symmetrical tree.

Little pruning is required in bearing trees. Should the grove become densely over-grown, lateral growth may be reduced to admit light and induce the development of fruit-bearing spurs (Plate 13). Some leaders may also require shortening to prevent the trees from becoming too tall for normal cultural operations in the orchard. Pruning is done towards the end of winter after the crop is harvested.

Plate 13.
Macadamia Nut Tree in Bloom.

Plate 14.
Single Spray of Macadamia Blooms.

Nutrition.

The Macadamia grows best in soils well supplied with humus, and farmyard manure should be added to the soil if it is available; alternatively, green manure crops can be grown in summer, when they will not make too heavy a demand on soil moisture. Of the inorganic plant foods, nitrogen is usually deficient in the majority of soil types

near the coast, but phosphates and potash are present in reasonable amounts. Under orchard conditions, regular applications of fertilizer will be found advantageous. A complete fertilizer with an 8:10:5 or similar formula is satisfactory when used at the rate of 1 lb. per tree per year of age, with a maximum of 10 lb. The most satisfactory time to apply the fertilizer is in early spring just before the trees make new growth and commence to blossom.

In several orchards, zinc deficiency (Plate 15) has been reported, the symptoms being small, yellowish and sometimes slightly mottled leaves which are bunched fairly closely together. The affected trees crop poorly and shoot growth is retarded. The disorder can be corrected by the application of foliage sprays, mixed according to the following formula:—10 lb. zinc sulphate, 3¾ lb. soda ash (or 5 lb. hydrated lime), 100 gallons water. The spray is best applied in early spring after the first flush of new growth, but reasonably good results are obtained at practically any period of the year.

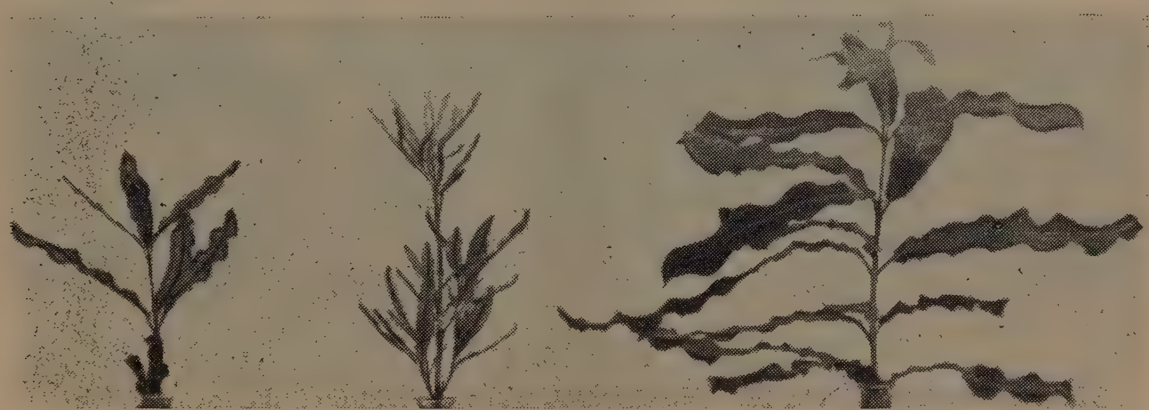

Plate 15.

Zinc Deficiency in the Macadamia Nut. Compare normal terminal (right) with affected terminals (left and centre).

Cultivation.

Many roots of mature trees are fairly close to the surface of the ground, and in the orchard, therefore, cultivation for weed control should be shallow. Weeds are kept down at all times. Cowpeas such as Poona pea make an excellent cover crop during the wet summer months, and an early autumn green manure such as New Zealand blue lupin is useful in irrigated areas. Harvesting takes place during late autumn and winter and the collection of the nuts from the ground is relatively easy if the orchard is kept clean during this period. In older groves, animals are sometimes grazed on volunteer grass and weeds, and this practice may possibly replace the usual method of soil management; it has the advantage of adding animal manure to the soil.

Harvesting.

The nuts mature (Plate 16) in six to seven months after blossoming and must be allowed to ripen on the tree, for immature kernels quickly become infected by moulds which make them inedible. On reaching full maturity the majority of nuts fall to the ground, but in some strains the nuts are more persistent and must be removed from the tree by means of a rake. After harvesting, the nuts are de-husked in machines of various types; a corn sheller can be improvised to perform this

operation with remarkably good results. The nuts are then washed to remove any discoloration caused by adhesions to the husk, thus leaving the shell an even brown colour after drying. At least a month should be allowed for the nuts to "harden off" before they are bagged and despatched to market.

Plate 16.

Mature Clusters of the Macadamia Nut. The splitting of the outer husk indicates maturity.

Grading the nuts according to size gives the product a desirable appearance and also assists mechanical handling by processors. A simple, but effective, grader (Plate 17) for sizing the nuts into small, medium and large grades can be readily constructed from case timber. The nuts are rolled between the edges of two inclined boards which diverge from a spacing of $\frac{1}{2}$ inch where the nuts enter to $1\frac{1}{2}$ inches at the far end. Suitably sized boxes are placed beneath the slots to receive the nuts as they fall through. Spherical nuts grade more evenly than ovoid types and it is therefore advisable to separate the two types in the orchard when the crop is harvested.

Shelling.

The toughness of the shell in most of the nuts marketed at present limits sales for dessert purposes. However, several efficient hand-operated crackers are available which crack the shell with little effort and turn out the kernel undamaged. Machinery for cracking the shells has also been designed for processing purposes. During the cracking process, some kernels are unavoidably broken but these are used by confectioners.

Shelled kernels do not deteriorate to any appreciable extent if kept in sealed jars away from light and moisture, the flavour and oil content being maintained. As a roasted and lightly salted confection, they are in strong demand and this treatment enhances their natural good keeping qualities.

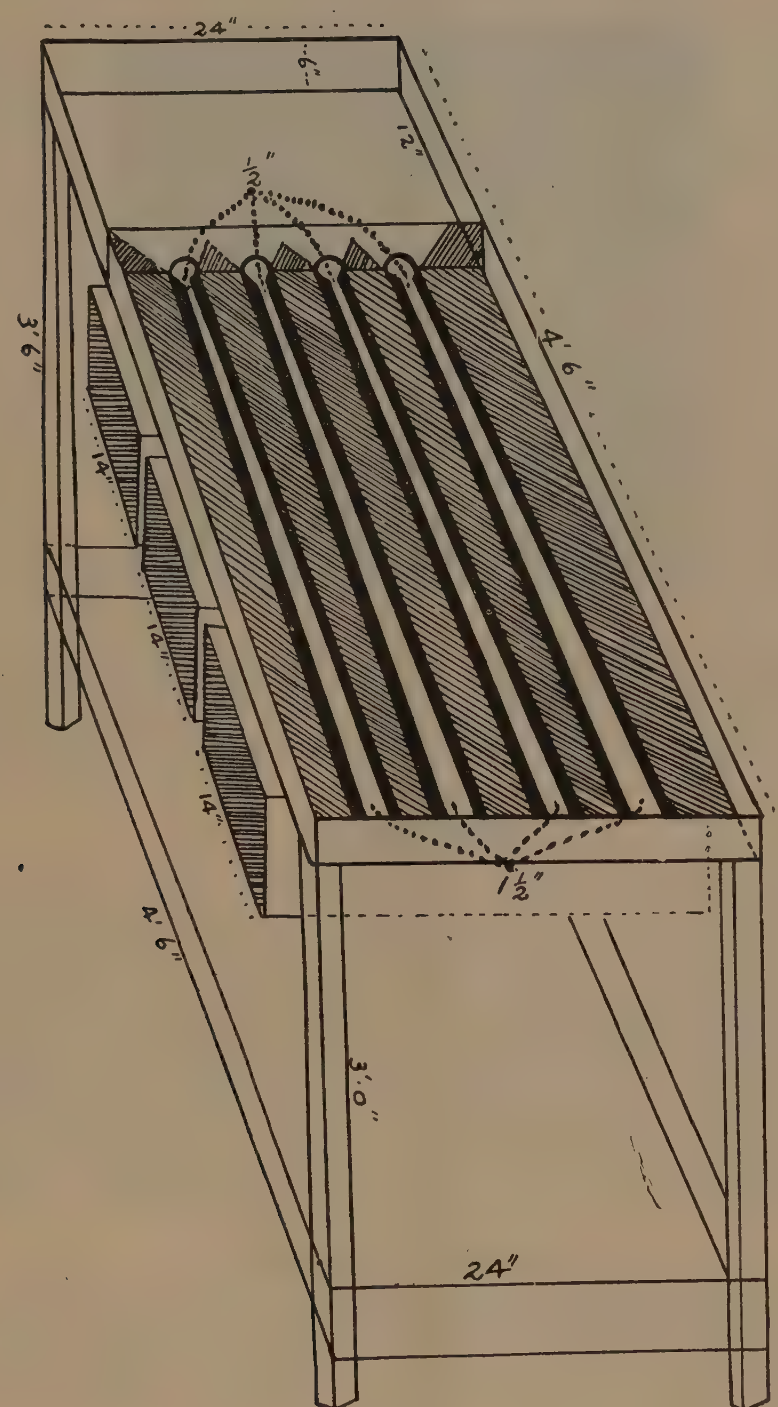

Plate 17.

Grader for Macadamia Nuts. The nuts should roll down the groove and fall into the appropriate box underneath.

Yields.

Under optimum conditions, seedling trees produce their first crop when six to seven years old, but in some strains cropping does not begin until the tenth or twelfth year. However, vegetatively propagated trees should commence bearing at an earlier average age.

Yield records based on seedling trees show wide variations due to strain characteristics and environmental effects. In favoured localities, yields of 300 lb. per tree have been obtained annually from mature trees over 14 years of age. The performance of grafted trees (Plate 18) has still to be determined.

Plate 18.

Top-working the Macadamia Nut. Vigorous but unprofitable trees may be bark grafted with scions from a better strain. Three scions are grafted to a sawn-off branch and waxed. A side wedge graft may also be used on small branches.

WALNUTS.

Nowhere in Queensland is the climate ideal for the production of the walnut (*Juglans regia,* family *Juglandaceae*). The walnut makes an excellent shade tree in the cooler parts of the State but yields of marketable nuts are usually low. The tree is exacting in its climatic requirements, as it is easily damaged by late frosts in the spring and will not tolerate high temperatures in summer. Temperatures in excess of 100 deg. F. are liable to prevent the development of kernels; if they do develop, the quality is seriously impaired. The walnut also has a relatively high water requirement, thriving best under rainfalls of 35 to 40 inches.

Soil Requirements.

The walnut grows into a large tree with luxuriant foliage and an extensive root system. Long-lived trees capable of high production are found only on rich, deep soils. Shallow clayey soils restrict growth, while deep sandy soils may require supplementary irrigation. Soils with a loamy texture offer the best prospects for the crop, but even these must have an open subsoil which drains freely to a depth of at least 10 feet. Walnuts are very susceptible to salt injury; consequently only a good grade of irrigation water should be used and care must be taken to prevent any rise in the water-table in irrigated orchards.

Propagation.

Most walnut groves in Australia are composed mainly of seedling trees of very variable quality. Trees worked on Northern Californian Black stock, which is readily raised from seed, are available, but few Australian nurserymen achieve a high percentage of "takes" and consequently vegetatively propagated trees are expensive. The most satisfactory results are obtained with patch budding, but nurserymen also graft the seedlings below ground, using the bark or wedge graft and heaping soil over the union. This operation is difficult and few growers attempt it.

Varieties.

Although most walnuts grown in Australia are seedling trees, commercial plantings should, as far as possible, be based on worked trees of varieties with a good reputation overseas. Varieties which have proved satisfactory in Australia are Franquette (a late flowering type) and Myrtleford Jewel (a Victorian seedling). Both are resistant to blight and produce a high quality nut. Other varieties of commercial interest are Concord, Eureka, Freshford Gem, Payne, Placentia and Treyve Mayette.

Planting.

Walnut roots are very susceptible to drying and young trees must therefore be handled carefully when transferred from the nursery to the orchard. The usual system of tree planting is adopted, followed by regular watering.

Tree spacings are wide when compared with those of other fruit trees, because of the large size to which these trees develop. A spacing of 50 x 50 feet should prove satisfactory under most conditions and nothing less than 40 x 40 feet is practicable. Some groves are planted with 60 feet between the trees and even then adjacent trees touch. During the early life of the grove, inter-row crops can be grown to defray the high cost of bringing the nut trees into bearing.

Pruning.

Very little pruning is required in the walnut. The young trees are headed at five or six feet and thereafter training consists of removing side shoots from the main trunk and preventing the development of too many main leaders. All leaders should be maintained at approximately the same length to give the tree a symmetrical shape. Internal laterals which are unwanted or out of position should be removed in their early stages. When the tree has assumed its regular shape, pruning is limited to the removal of dead wood.

Soil Management.

Soil management consists chiefly in maintaining the texture of the soil by the regular addition of organic matter, taking precautions against soil erosion and supplementing natural rainfall with irrigation in dry times. Cultivation should aim at controlling weeds, especially during the early autumn when harvesting is in progress.

Fertilizers are seldom used on walnut trees, as the soils planted are usually deep and well supplied with plant foods. Young trees should, however, benefit from light applications of a complete fertilizer mixture which is relatively rich in nitrogen.

Harvesting.

When mature, the nuts separate from the hulls and fall to the ground, but when harvesting is in progress, it is customary to shake the trees by means of poles fitted with hooks to accelerate nut fall. Nuts should not be allowed to lie on the ground for long periods, as the shells lose their colour quickly and the kernel may become mouldy. At times, some nuts have a persistent hull and these are referred to as "sticktights"; they should be kept separate from the other nuts as they are inferior in quality and include many blanks, or contain mouldy and discoloured kernels. After collection, the nuts are washed to remove dirt and stains and then quickly dried in the sun on shallow trays with

frequent stirring to accelerate the process. A really first class product can be prepared by dipping the nuts for from 5 to 10 seconds in a bleaching solution containing 25 lb. chloride of lime, 18 lb. soda ash and 50 gallons water to which sulphuric acid has been added at the rate of 1 lb. to 340 gallons.

THE PECAN NUT.

The pecan nut (*Carya oliviformis*, family *Juglandaceae*) is closely related to the walnut. The present production in Queensland is small, but annual plantings are increasing.

Climatic Requirements.

The pecan nut (Plate 19) crops well only in regions with a reasonably cool temperature during the winter months, and does best on the tablelands of the interior and in some parts of southern coastal Queensland. Late spring frosts are, however, injurious to young trees and any necessary precautions must be taken to protect them during the first few winters after planting. Trees grow luxuriantly in warm climates, but their cropping capacity is relatively poor. Male and female flowers are borne on the same tree and pollen is air-borne from one to the other. Rain at blossoming may therefore interfere with pollination and result in a poor crop.

Plate 19.
Pecan Nut Tree.

Soil Requirements.

Pecan nuts grow on a wide range of soils. Clay loams and loams overlying a free draining subsoil support vigorous trees and these types should be given preference in selecting the orchard area. Cultural practices which maintain a high organic matter content in the soil are desirable. The tree prefers a slightly acid soil with a pH value of 5·5 to 6·0.

Propagation.

Vegetative propagation is necessary for the production of commercial trees, but simple methods of budding are not very successful. Ring and patch budding have proved reasonably satisfactory when carried out by skilled operators. Rootstocks are raised from the seed of vigorous, fruitful parent trees with some resistance to scab. Germination is improved by soaking the seed in water for 36 to 72 hours before planting. The seed is, however, sometimes stratified—that is, packed in bands between layers of sand which is kept moist by a covering of about eight inches of soil. When the seed shows signs of germinating, it is planted direct into nursery rows four feet apart with 9 to 12 inches between the seeds. The seedlings are budded in the second growing season at any time when they are in active growth.

Some years ago, grafting was commonly practised, but it requires a greater quantity of budwood than budding. The whip-tongue graft was used for small stocks and the cleft or side grafts for stocks one inch or more in diameter.

Nursery care of the worked tree is the same as for other fruit trees except that the pecan develops a very long taproot, which must be cut when the top reaches a height of about 12 inches.

Planting.

The fibrous roots of the young tree are very susceptible to exposure and should be carefully protected when the trees are transferred from the nursery to the field. The land should be thoroughly prepared for the trees, ploughed deeply and, if necessary, sub-soiled. The trees are transplanted when the top is a year old and has reached a height of four to six feet. Planting should be done during the winter as soon as dormancy sets in so that the root system will be re-established in readiness for the spring growth. In planting, the tree is placed at about the same depth as it was in the nursery and then watered immediately.

Pecans develop into large trees and require a 50 to 70 feet spacing. Inter-planting with some early maturing crop will offset part of the cost of establishing the orchard.

Varieties.

There are approximately 180 known varieties of the pecan nut, many of which produce high quality nuts. Scab has been a serious disease in American orchards and preference is now given to those varieties with some resistance to the disease or those in which spraying for its control is an economic proposition. The most popular resistant varieties are Stuart, Farley, Desirable and Curtis. More susceptible varieties previously held in high esteem are Schley, Frotscher, Van Deman, Moneymaker and Pabst. Little information is available on varietal behaviour in Queensland, but it would appear advisable to plant scab-resistant varieties on the coast and perhaps try the better quality but scab susceptible varieties in the drier inland areas.

Pruning.

No systematic pruning is necessary beyond removing dead wood and branches which are out of position. Nuts are borne on terminal wood and vigorous growth is associated with heavy crops. Young trees should be headed at a height of about four feet and trained into a spreading, symmetrical form with a limited number of leaders.

Soil Management.

The root system of the pecan nut is extensive but relatively shallow, and accordingly, deep cultivation is undesirable. Disc implements should always be used in preference to tyne implements. It is the usual practice to apply clean cultivation during the summer, especially when the crop is harvested, and to plant a winter-growing green manure crop, such as New Zealand blue lupin, towards the end of autumn. By this means, soil organic matter is maintained, the best use is made of soil moisture and a minimum of inconvenience is caused during harvesting of the nuts.

Yields of nuts are influenced considerably by fertilizing and an 8:10:8 or similar mixture at the rate of 2 lb. per tree per year of age up to 25 years should prove effective. This is best applied in two applications, one in early spring and a second when the nuts are about half-grown.

Rosette, which is an indication of zinc deficiency, frequently appears in pecans as a yellowing and mottling of the new leaves at the top of the tree combined with a shortening of the internodes. In severe cases, terminal twigs and branches die back and the trees become unproductive. Soil dressings of zinc sulphate, 1 to 2 lb. for each inch of trunk diameter, are an effective remedy in acid soils, but in neutral or alkaline soils the zinc–lime spray used for zinc deficiencies on citrus will be found satisfactory.

Harvesting.

The crop is harvested in the autumn from April to May. When the nuts mature, the hulls open and the nuts fall to the ground, but shaking or jarring the branches may be needed to dislodge the more persistent nuts. The nuts are gathered by hand or preferably collected on a canvas or burlap sheet spread under the tree. They should then be washed to remove foreign matter and rapidly dried before being stacked 6 to 8 inches deep on a well ventilated floor for curing. Shrinkage is complete in about a month and the nuts are then placed in sacks and marketed as whole nuts.

Yields.

The age at which a tree comes into bearing depends on the variety and the care given to the orchard. Under favourable conditions, some varieties bear within three years, but late types take up to six years. Worthwhile commercial crops should be produced in 8 to 12 years.

The average yield of mature trees is influenced by such things as climate, variety, soil type, fertilizer practices, insect pests and disease. About 100 lb. per tree is considered a very good crop, but recorded yields usually range from 25 to 80 lb. per tree.

Beekeeping Legislation.

"The Apiaries Act of 1947."

C. ROFF, Adviser in Apiculture.

LEGISLATION on beekeeping in Queensland dates from 1931, when the first Apiaries Act was passed. Primarily it gave power to deal promptly and adequately with outbreaks of diseases of bees. A natural adjunct to this was a system of approval and registration of apiary sites so that inspections for disease would be facilitated. It was also required under the Act that any bees or beekeeping materials introduced into the State should be certified as free from disease. These basic principles were maintained in "*The Apiaries Act of* 1938," and in addition, a certain degree of control of the industry was introduced to prevent overstocking of localities or encroachment between apiaries in south-eastern Queensland, where the greater proportion of the apiaries of the State were located.

The degree of protection against encroachment, under the Act of 1938, proved to be excessive, as relatively small apiaries could hold territory that was capable of carrying a greater number of hives and, consequently, of yielding a much larger crop of honey. New apiaries could be established only at distances further apart or further from existing apiaries than is now considered necessary. There was also a tendency to limit the increasing number of migratory beekeepers from utilising potentially profitable areas. This was substantiated by instances where beekeepers, by mutual consent, as was allowed under the Act, positioned large apiaries at short distances without detrimental effects.

To correct shortcomings of the 1938 Act, "*The Apiaries Act of* 1947" was passed. This Act came into force on 31st March, 1948, and the following explanation should enable all beekeepers to become conversant with its requirements. The Act is divided into parts, but for convenience, it will be discussed under headings relating to requirements in declared districts, to the control of disease in the State as a whole, to the prevention of the introduction of disease and also to some general provisions.

Plate 20.

A Queen-rearing Apiary in Southern Queensland.

Plate 21.

A Migratory Beekeeper's Honey Extracting Plant at Inglewood.

Requirements in Declared Districts.

Districts.—The pastoral districts of Moreton, Darling Downs, Wide Bay and Burnett have been declared as Districts for the purposes of Part II. of the *Apiaries Act.* Within this area of south-eastern Queensland a system of registration is provided which is somewhat different from that under the previous Act.

Registration.—On 31st March in each year, every beekeeper, irrespective of the number of hives, must apply for registration and in doing so must supply certain information on a prescribed form regarding his apiary or apiaries. At a later date, he receives his certificate of registration for the period up to 31st March in the following year. No person is permitted to keep bees unless he is a registered beekeeper. No fees are charged under the Act.

Classification of Apiaries and Distance Limitations.—Unless an inspector decides that a locality has become excessively stocked, no restrictions are imposed on the placing of apiaries consisting of less than forty hives, and for convenience these apiaries are known as Apiaries Class A. Apiaries Class B are those consisting of forty hives or more. *The minimum distance between apiaries of this class is set down as half a mile.*

An Apiary Class C is one consisting of at least forty hives in which queen bees are bred for sale. A certificate indicating that an apiary is an Apiary Class C is issued only after the inspector has certified that the apiary is suitable for the purpose. *The benefit derived from this particular classification is that no other beekeeper is allowed to commence a new apiary within a radius of one mile of an Apiary Class C.* This restriction is provided to help the commercial queen-breeder to maintain the purity of his strain, but it may be noted that any apiary already established within the prescribed limits will not be affected.

The holder of a certificate for an Apiary Class C may, however, give consent for any person to establish an apiary within the one-mile radius, subject always to Department approval.

Certain apiaries consisting of forty hives or more may be classified as Apiaries Class D. The site of such an apiary is intended to be available as a protected site in the event of the beekeeper desiring from time to time to leave it to follow a honey flow. Before a certificate will be issued, the beekeeper concerned must possess a total of at least one hundred and fifty hives, and in effect the site must be one that an inspector considers to be a suitable and convenient centre for that beekeeper's activities. *The owner of an Apiary Class D may remove any or all of his bees from that site to any other site without loss of rights, and in the period between this action and the re-occupancy of this site it is an offence for another beekeeper to establish an Apiary Class B within the half mile radius.* However, in any certificate issued in connection with an Apiary Class D, conditions may be imposed to ensure that such a site is properly "worked" and that other beekeepers are not being unnecessarily restricted in that area. Certificates may be revoked at any time and the number of Apiaries Class D allotted to any beekeeper is determined by the Department.

A beekeeper having either an Apiary Class B or an Apiary Class D may give his written consent for any other beekeeper to establish an Apiary Class B or D at a distance of less than half a mile. If an inspector, after considering the local situation, is of the opinion that the establishment of a new Apiary Class B or D would not prejudice an already established Apiary Class B or D, then permission may be granted for the new apiary to be established and maintained for some determined period.

Sales and Removals.—If a beekeeper sells, establishes or removes an apiary, he must advise the Department of his action within fourteen days. Forms are available for this purpose.

Prohibited Apiary Sites.—The keeping of bees on a site may be prohibited if any provision of the Act is being contravened or not complied with, or if the site has become unsuitable for beekeeping, or if the keeping of bees there is detrimental to public interest. Such a site then becomes known as a prohibited apiary site. If any person establishes or maintains an apiary upon such a prohibited apiary site he is guilty of an offence under the Act.

Registered Brands.—It is necessary for each beekeeper to mark at least one hive in every fifty or part thereof with his registered brand number. This brand number is supplied to each registered beekeeper on his certificate of registration. The marking must be in block letters and figures not less than two inches high and must always be maintained in a legible condition. The marking is to be placed on the front of the hive, and at least one of the hives marked shall be situated in the front row of hives.

Control of Disease throughout Queensland.

The part dealing with the control and restriction of diseases and pests affecting bees is by far the most important portion of the Act and it is in force throughout the whole State.

Frame Hives.—Linked with inspectional work is the necessity to have good facilities for examining hives, and therefore beekeepers are required to keep their bees in frame hives maintained in good condition. A badly constructed or neglected frame hive makes effective examination for the presence of disease very difficult.

Disease Notification.—In the event of a beekeeper noticing a disease in his apiary, he must notify the Department immediately; further, he must not sell or in any way dispose of any bees or materials while they are affected with or liable to spread disease.

Destruction of Diseased Material.—Under the Act power is given to the Minister to order the destruction of any diseased bees or disease-affected material. However, such action will follow only if an inspector has certified that in his opinion the diseased apiary is a source of danger to other bees and ought to be destroyed and the certificate is countersigned by the Director, Division of Plant Industry.

Quarantine.—Particular areas or buildings may be declared quarantine areas for the purpose of disease control. Until a quarantine is lifted, no person is allowed to remove bees or beekeeping material into, within or out of the area.

Disease Control Powers.—In connection with disease control, samples may be taken by an inspector for investigation, vehicles stopped and inspected, consignments directed to a quarantine area for investigation, instructions given regarding methods of treatment to be carried out and generally any other action may be taken or ordered that may be necessary to effect efficient control.

Queensland has been comparatively free from diseases in bees in the past and every endeavour must be made to keep it so in the future. The requirements relating to diseases were designed with this in mind, and normally they involve very little inconvenience to beekeepers.

Prevention of the Introduction of Disease.

Places of Entry.—In coastal Queensland and along the southern border, certain towns are listed as places of entry. All bees, bee combs, beeswax, hives, honey and appliances coming into this State must come through one of these listed places. By "appliances" is meant gear or apparatus that has been used in beekeeping but it does not refer to new goods. The places of entry are Bowen, Brisbane, Bundaberg, Cairns, Clapham Junction, Coolangatta, Gladstone, Goondiwindi, Killarney, Mackay, Maryborough, Mungindi, Rathdowney, Rockhampton, Texas, Townsville, Wallangarra.

Restriction on Introductions into Queensland.—A consignment coming into Queensland must be accompanied by a declaration completed by the consignee and a certificate must be completed and signed by an approved officer in a Department in the State or country of origin corresponding to the Department of Agriculture and Stock in Queensland to the effect that the consignment comes from a disease-free district. A duplicate copy of this declaration and certificate shall, prior to the introduction, be forwarded to the Department of Agriculture and Stock, Brisbane.

Power to Quarantine Consignments.—Upon arrival at a place of entry the consignment may be directed to a quarantine area for examination, and if found to be affected by disease, it may be detained in quarantine and treated in accordance with instructions.

Power to Return or Destroy Consignments.—A consignment coming into this State without the necessary declaration and certificate shall be either returned to the sender or destroyed in quarantine.

Normally, any consignment coming to the State through a place of entry and accompanied by a properly completed certificate of freedom from disease will not be delayed.

General Provisions.

Beekeeper to Supply Information.—A beekeeper may be required to furnish information regarding queen bees supplied by him or such statistics pertaining to beekeeping as an officer appointed under the Act may reasonably require of him.

Abandoned and Neglected Hives.—In the event of an inspector being satisfied that any bees, hives or appliances have been abandoned and are neglected, he may take possession of them and dispose of them in a prescribed manner or in accordance with instructions from the Under Secretary. This provision may sometimes be very necessary, for an abandoned apiary can easily become a source of nuisance or danger to beekeepers in the locality.

Honorary Field Men.—Honorary field men may be appointed and when required to do so may inquire and report on registration of beekeepers, location of apiaries, classification of apiaries, keeping of bees in frame hives, contraventions of the Act or such other matters as may be thought necessary by the Under Secretary. Honorary field men must be registered beekeepers and appointment will automatically lapse if beekeeping is relinquished by them.

Summary.

The main provisions of the Act may be briefly summarized as follows:—

1. Beekeepers throughout Queensland must keep their bees free from disease and in frame hives to permit of effective examination.
2. Beekeepers in the declared districts must register, provide descriptions of their apiaries, maintain a distance of at least one-half mile between apiaries of forty hives or more, and display their brand number on their hives.
3. All introductions of bees, honey, &c., must be certified as having come from an area free from disease.

Diagnosis of Bee Diseases.

When notifying an outbreak of disease in his apiary, the beekeeper will assist himself, the industry and the Department by sending samples of brood comb for examination by Departmental officers. The piece of comb should measure at least 4 inches by 5 inches and contain as much of the discoloured or dead brood as possible. No honey should be present, and the comb should not be crushed. A wooden or strong cardboard box only should be used for packing the sample, which should be accompanied by an explanatory letter.

ANIMAL HEALTH

Birdsville Disease of Horses.

Prepared by Officers of the Animal Health Station, Yeerongpilly.

FOR very many years a rather unusual disease of horses has been known to occur in parts of western Queensland, being most common in the south-western part of the State, where it was called Birdsville disease after a small township in the area. It is now known to occur in districts as far north as Cloncurry and some years ago cases were seen west and south of Winton in Central-Western Queensland. It is also found in certain parts of the Northern Territory and occasionally in the northern parts of Western Australia.

Recent experimental work has shown this disease to be due to the eating of the plant *Indigofera enneaphylla* (Plate 22).

Symptoms of the Disease.

Grazing horses of all ages are affected. One of the most common signs first seen is a dull sleepy attitude often associated with an uncertain gait. The animal takes little notice of its surroundings and when it moves it often has difficulty in controlling the placement of its hind legs. It easily loses its balance and may lurch a little when walking and sway from side to side. Apparently there is also some difficulty in raising the hind feet from the ground and as a result there is dragging of the foot which in time rounds off the horn of the toe of the hind hooves. This wearing of the horn of the toe is often the only sign noted in many station horses and it indicates a mild chronic form of the disease.

The disease can progress quite rapidly from the time the first symptoms are noted. The dull sleepy attitude is aggravated, the wobbling becomes worse and the animal soon becomes recumbent, often struggling for hours before death.

Some animals appear to recover to a degree and stock-owners have said that the same horse may be affected for two or three years running, appearing to recover partly, if not wholly, after each attack.

Some of these ''recovered'' cases are quite deceptive. If such horses, which may otherwise be in prime condition and look at first sight to be quite healthy, are galloped they move off smartly at a rapid pace and with a free action. Before half a mile has been covered they start to lose balance and pull up to prevent themselves from falling. If approached they show the greatest distress. They lurch and sway and may fall violently to the ground. On the ground they may show violent tetanic spasms for several seconds while stretched out on their side. Immediately these spasms pass off the affected beast rises at once and

the lurching and swaying commences once again. Such an animal may exhibit great difficulty in respiration. The mouth may be wide open, the nostrils widely dilated, and the air movements in and out through the trachea cause a "roaring" sound. The exact part of the respiratory tract at which this roar occurs has not been determined. Bleeding from the nose has been noted in some of these cases by competent observers.

Plate 22.

A Plant of Indigofera enneaphylla.

Stock-owners state that if one wishes to determine whether any horses of a mob are affected all that is necessary is to gallop them for half a mile, when the affected ones will drop out.

Many station workers show a distinct aversion to riding horses which have been known to have had an attack of the disease because of their tendency to show respiratory distress and uncertain gait if ridden hard after cattle.

On post-mortem examination, no lesions are found in the carcase. This is one of the features of the disease.

The Indigofera Plant.

This legume has no common name. It is generally an annual or biennial with a strong central taproot. It is usually prostrate and in good seasons may have a spread of 2 to 3 feet. Its flowers are bright red and the pods very small, usually with two small seeds.

It is a common tropical weed and occurs outside Australia (for example, in southern Asia and the East Indies). Mostly found in Australia in the tropics and subtropics, it is very scattered in the coastal areas but more abundant in the south-western corner of the State and in the area south and west of Cloncurry. It is very common around the bases of the sandhills in the area west of Windorah, especially after good rains. Here it often forms a fairly high percentage of the available grazing and hence it is here the disease is most common.

It is also common in parts of Central Australia and in places in the north of Western Australia.

All observers state that the plant is palatable and readily consumed by horses.

Control of the Disease.

It is difficult to control or prevent the disease except by moving animals right off the affected pastures. Observation has shown that the distribution of the plant varies very much and on some properties it is possible to fence in areas where it is absent or only present to a limited degree. This has already been done in some places. Where possible, drovers with stock should camp in areas where the plant is absent or forms only a small percentage of the pasture and thus keep the amount likely to be eaten by the grazing horses to a minimum. This is often quite practicable.

When cattle are being mustered on stations, camping places should be selected where there is little Indigofera plant which can be grazed. In addition, hand-feeding of the station horses should be practised where practicable.

Admittedly these are only suggestions and cannot always be applied, but much can be undoubtedly done to minimise losses now that the cause of the disease is known.

CHANGE OF ADDRESS.

Journal subscribers notifying change of address should state their full Christian names and surname as well as their full former and new addresses.

Address all communications to the Under Secretary, Department of Agriculture and Stock, Brisbane.

TUBERCULOSIS-FREE CATTLE HERDS.

(AS AT 12th JUNE, 1952.)

Breed.	Owner's Name and Address of Stud.
Aberdeen Angus	The Scottish Australian Company Ltd., Texas Station, Texas
	F. H. Hutton, "Bingegang," Dingo
A.I.S.	F. B. Sullivan, "Fermanagh," Pittsworth
	D. Sullivan, "Bantry" Stud, Rossvale, *via* Pittsworth
	W. Henschell, "Yarranvale," Yarranlea
	Con. O'Sullivan, "Navillus Stud," Greenmount
	H. V. Littleton, "Wongalea Stud," Hillview, Crow's Nest
	J. Phillips and Sons, "Sunny View," Benair, via Kingaroy
	Sullivan Bros. "Valera" Stud, Pittsworth
	Reushle Bros., "Reubydale" Stud, Ravensbourne
	H. F. Marquardt, "Chelmsford" Stud, Wondai
	W. G. Marquardt, "Springlands," Wondai
	A. C. and C. R. Marquardt, "Cedar Valley," Wondai
	A. H. Sokoll, "Chelmsford," Wondai
	W. and A. G. Scott, "Welena," A.I.S. Stud, Blackbutt
	G. Sperling, "Kooravale" Stud, Kooralgin, via Cooyar
Ayrshire	L. Holmes, "Benbecula," Yarranlea
	J. N. Scott, "Auchen Eden," Camp Mountain
	"St. Christopher's and Iona" Studs, Brookfield Road, Brisbane
	E. Mathie and Son, "Ainslie" Ayrshire Stud, Maleny
Friesian	C. H. Naumann, "Yarrabine Stud," Yarraman
	J. F. Dudley, "Pasadena," Maleny
Guernsey	C. D. Holmes, "Springview," Yarraman
Jersey	W. E. O. Meier, "Kingsford Stud," Rosevale, *via* Rosewood
	J. S. McCarthy, "Glen Erin Jersey Stud," Greenmount
	J. F. Lau, "Rosallen Jersey Stud," Goombungee
	G. Harley, Hopewell, Childers
	Toowoomba Mental Hospital, Willowburn
	Farm Home for Boys, Westbrook
	F. J. Cox and Sons, "Rosel" Stud, Crawford, Kingaroy Line
	R. J. Browne, Hill 60, Yangan
	P. J. L. Bygrave, "The Craigan Farm," Aspley
	A. Verrall and Sons, "Coleburn Stud," Walloon
	R. J. Crawford, "Inverlaw Jersey Stud," Inverlaw, Kingaroy
	P. H. F. Gregory, "Carlton," Rosevale, *via* Rosewood
	E. A. Matthews, "Yarradale," Yarraman
	A. L. Semgreen, "Tecoma," Coolabunia
	G. & V. Beattie, "Beauvern," Antigua, Maryborough
	L. E. Meier, "Ardath" Stud, Boonah
	A. M. and L. J. Noone, "Winbirra," Stud, Mt. Esk Pocket, Esk
	W. S. Conochie and Sons, "Brookland" Stud, Sherwood Road, Sherwood

A SPECIAL RADIO SERVICE FOR FARMERS

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The Importance of the Animal Protein Factor in Rations for Growing Pigs.

K. J. HUTCHINSON, Assistant Husbandry Officer, Pig Branch.

PIG producers have realised for many years that young growing pigs need some feeding-stuff of animal origin as part of their ration if good growth is to be obtained. It has only been of recent years, however, that a vital clue in the explanation of this situation has been found, this being the discovery of vitamin B12, or, to use a broader term, the Animal Protein Factor.

It would appear that although the Animal Protein Factor (A.P.F.) is probably a complex, and not one simple substance, vitamin B12 is by far the most important single constituent. It should be pointed out that all our animal protein concentrates (for example, milk and milk by-products, fishmeal, and meatmeal) are comparatively good sources of A.P.F. or vitamin B12, and that without exception feeding-stuffs of vegetable origin (for example, grains, linseed meal, peanut meal, and lucerne) contain little if any. The presence or absence of A.P.F. does much to explain observed differences in growth potential between these two classes of feedstuffs and why growing pigs need some source of animal protein in their rations if they are to make satisfactory gains.

TYPES OF A.P.F. SUPPLEMENTS.

Since the discovery of the Animal Protein Factor there has been a rapid development overseas of various A.P.F. supplements. These contain a large concentration of A.P.F. and overseas have proved useful in supplementing all-vegetable rations and thereby improving growth (Plate 23).

A.P.F. supplements may be broadly grouped into two main types. Firstly, there are those which are in reality concentrated animal by-products, such as condensed fish solubles and condensed whale solubles. The second group would be better classed as vitamin B12 supplements, since they are not manufactured from any animal source but are the commercial products of fermentation processes using suitable micro-organisms. It should be mentioned that certain strains of these micro-organisms provide very efficient means whereby vitamin B12 can be manufactured commercially for use as a supplement.

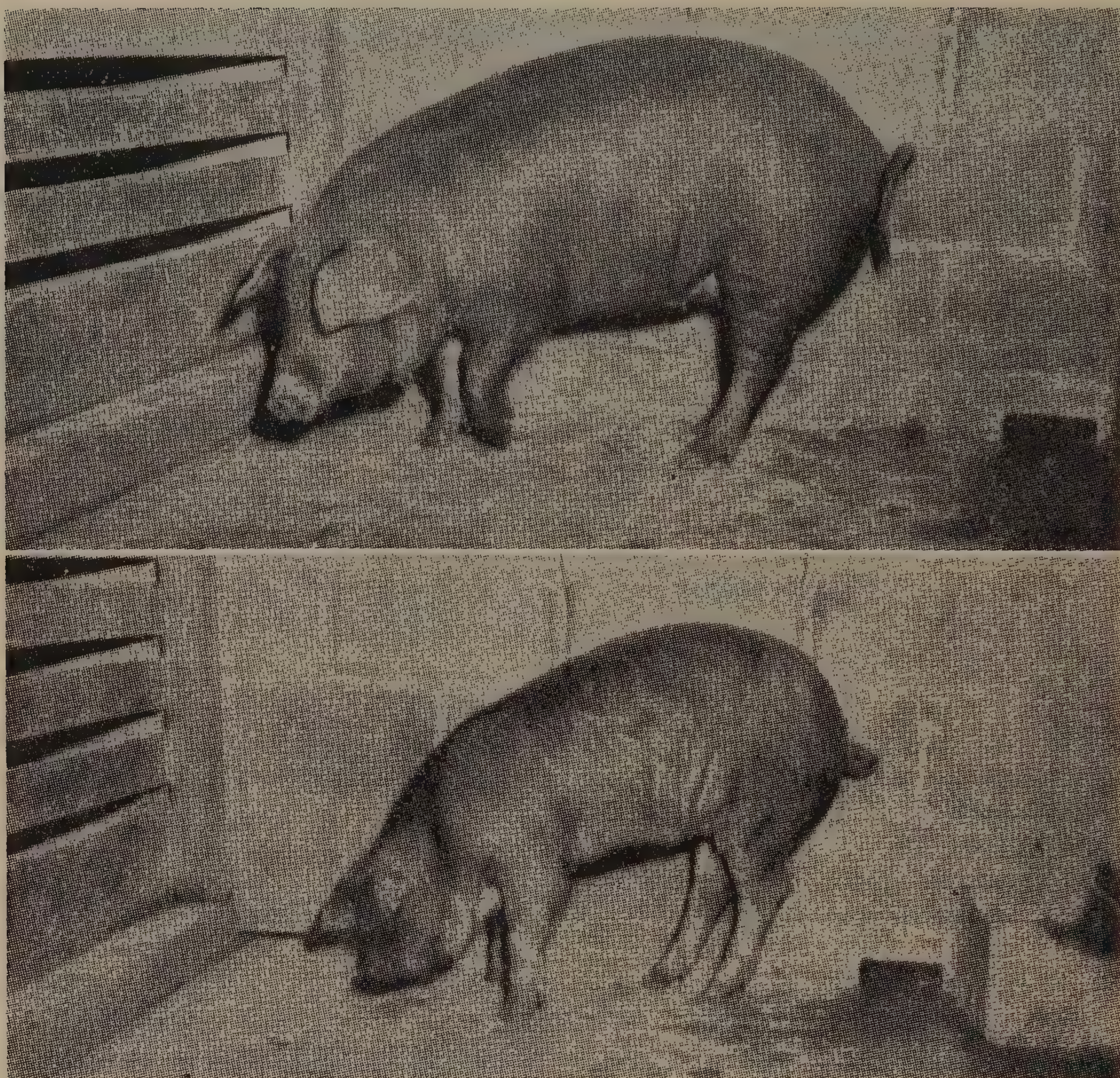

Plate 23.

Value of Animal Protein Factor.—Both pigs received the same all-vegetable meal ration, but the one at the top was fed an animal protein factor supplement as well.

[*Photo. from Florida Agricultural Experiment Station Circular S.* 13.]

THE VALUE OF A.P.F. SUPPLEMENTS.

It has already been pointed out that the addition of an A.P.F. supplement to an all-vegetable ration will yield better growth. However, the final response to such supplementation will depend on two things:—

(1) the efficiency of the supplement in providing the needs of the animal for A.P.F.;

(2) the basic quality of the ration which is to be supplemented.

The second point is an important one. A.P.F. is only one of the many essential factors which determine the growth potential of a ration, and comparative failure from an A.P.F. supplemented ration does not necessarily reflect on the quality of the supplement.

CONDENSED WHALE SOLUBLES AS A SOURCE OF A.P.F.

Recently the Pig Branch of the Department carried out an investigation into the possible A.P.F. supplementary value of a by-product of the Australian whaling industry known as condensed whale solubles (C.W.S.).

C.W.S. is a dark-brown, viscous fluid of similar consistency to molasses. It has a high moisture content (about 50 per cent.); the remainder is largely protein. To test its A.P.F. value, growth figures from three experimental rations were compared. Briefly, the rations and results obtained were as follows.

Experimental Rations.

Group 1.—An unsupplemented grain sorghum-peanut meal and linseed meal ration, devoid of A.P.F.

Group 2.—A grain sorghum-peanut meal and linseed meal ration incorporating 8 per cent. condensed whale solubles as a source of A.P.F. to be studied.

Group 3.—A grain sorghum-meatmeal ration. This ration would supply the dietary needs of young growing pigs for A.P.F. and was included for comparative purposes.

Conclusions.

With Grain Sorghum-Peanut Meal and Linseed Meal Rations:—The addition of 8 per cent. condensed whale solubles to this all-vegetable protein ration provided a growth increase of 27 per cent.

The pigs on the unsupplemented ration were obviously unthrifty, and their A.P.F. deficient diet led to a decreased appetite and a loss of bloom. The absence of these symptoms and the increased growth rate in Group 2 provide evidence that condensed whale solubles contains the Animal Protein Factor.

Comparison of C.W.S. Supplemented Ration (2) *with the Grain Sorghum-Meatmeal Ration* (3):—As shown hereunder, and in Plate 24, the grain sorghum-meatmeal ration proved vastly superior to the C.W.S. supplemented ration in terms of both growth rate and economy of feed consumption.

Ration.	Growth. (Liveweight Gain in Pounds per Day.)	Economy of Gain. (Pounds Consumed per lb. Liveweight Gain.)	Feeding Cost per lb. Liveweight Gain. (Approx. 1951 Figures.)
			d.
Grain sorghum—Peanut meal and Linseed meal with 8% C.W.S.	·80	4·12	10·35
Grain sorghum—Meatmeal	1·04	3·57	8·27

These differences may be explainable in terms of inferiority in the basic quality of the basic ration which was supplemented with condensed whale solubles. It does not necessarily reflect the inability of an 8 per cent. C.W.S. supplement to provide an adequate dietary source of A.P.F. for young growing pigs.

SUMMARY.

To obtain efficient growth, growing pigs need some source of the Animal Protein Factor in their diet.

Consequently, rations based entirely on feeding stuffs of vegetable origin are unsatisfactory.

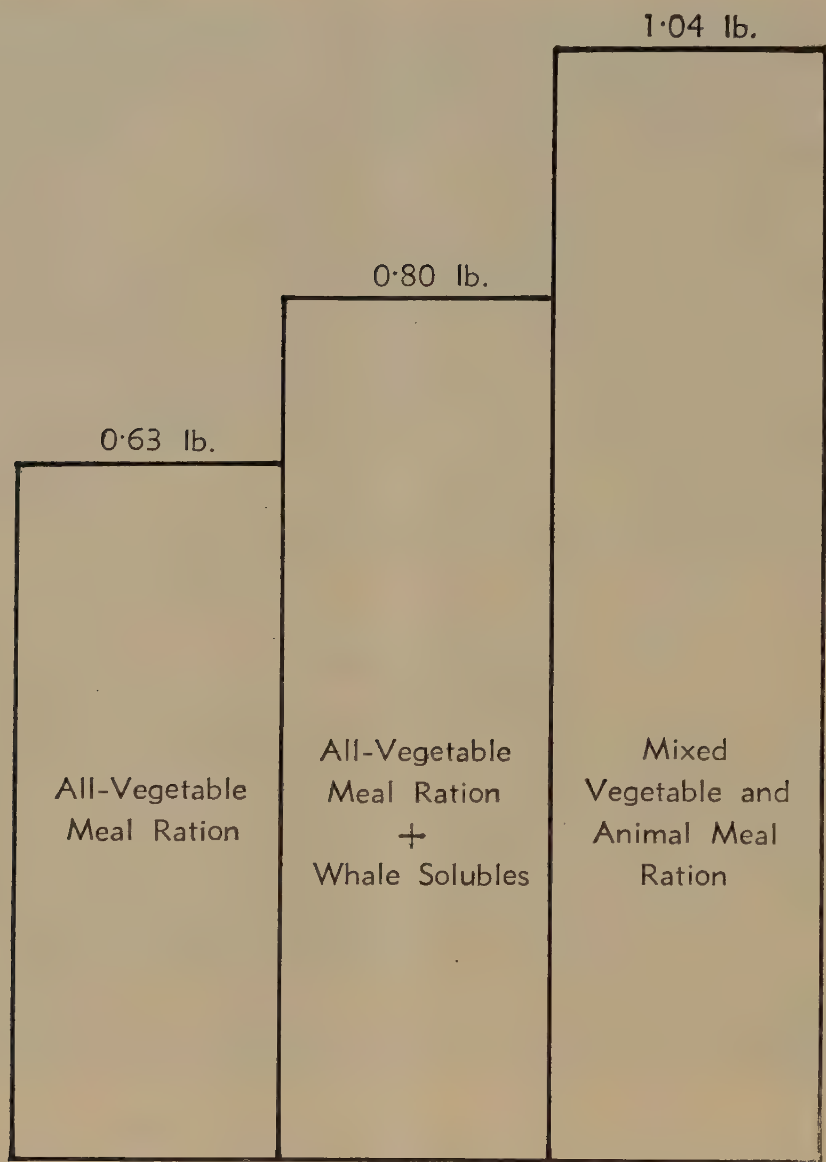

Plate 24.

Diagram Showing the Relative Daily Liveweight Gains of Pigs fed on Various Rations.

It is possible to increase the efficiency of all vegetable rations by adding a satisfactory A.P.F. or vitamin B12 supplement. However, such supplemented rations will yield results comparable to proven rations (for example, one based on meatmeal) only if the basic quality of the unsupplemented ration is satisfactory.

At present, the most satisfactory way of supplying the dietary needs of young growing pigs for A.P.F. is to use an adequate amount of some feeding stuff of animal origin. Such feeding stuffs which contain A.P.F. include milk and milk by-products, meatmeal, fishmeal and whale meatmeal.

Brucellosis Testing of Swine.

The Department of Agriculture and Stock is operating a scheme whereby pig herds are tested at intervals for the occurrence of swine brucellosis (contagious abortion).

A herd listed by the Department as "brucellosis tested" is one in which all such animals as may be determined by the Director of the Department's Division of Animal Industry have been subjected to two successive tests for brucellosis, at intervals determined by him, without any positive reactors being found.

In order for a herd to be retained on the list of Tested Herds, a semi-annual or annual re-test of the herd, as determined by the Director, is required. If at a re-test any animal gives a positive reaction to the test the herd is removed from the list; it is not listed again until subsequent tests, as determined by the Director, have been carried out.

Full particulars of the Brucellosis Testing of Swine and application forms may be obtained from the Under Secretary, Department of Agriculture and Stock, William Street, Brisbane.

TESTED HERDS.
(AS AT 12th JUNE, 1952.)

Breed.	Owner's Name and Address of Stud.
Berkshire	S. S. Ashton, " Scotia " Stud, Pittsworth
	J. J. Bailey, " Lucydale " Stud, East Greenmount
	S. Cochrane, " Stanroy " Stud, Felton
	Garrawin Stud Farm Pty. Ltd., 657 Sandgate road, Clayfield
	G. Handley, " Handleigh " Stud, Murphy's Creek
	J. L. Handley, " Meadow Vale " Stud, Lockyer
	R. G. Koplick, " Melan Terez " Stud, Rochedale
	H. V. Littleton, " Wongalea " Stud, Crow's Nest
	O'Brien and Hickey, " Kildurham " Stud, Jandowae East
	E. Pukallus, " Plainby " Stud, Crow's Nest
	G. C. Traves, " Wynwood " Stud, Oakey
	E. Tumbridge, " Bidwell " Stud, Oakey
	Westbrook Farm Home for Boys, Westbrook
	H. W. Wyatte, Rocky Creek, Yarraman
	H.M. State Farm, " Palen Creek," Palen Creek
	A. R. Ludwig and Sons, " Cryna " Stud, Beaudesert
	H. H. Sellars, " Tabooba " Stud, Beaudesert
	F. Thomas, " Rosevale " Stud, Beaudesert
	Bowkett and Meacle, " Myola Vale " Stud Piggery, Burra Burri, Jandowae
	D. T. Law, Trouts Road, Aspley
	R. J. McCullough, " Maxholm " Berkshire Stud, Gatton
	C. F. W. and B. A. Schellback, " Redvilla " Stud, Kingaroy
	R. H. Crawley, "Rockthorpe" Stud, via Pittsworth
	F. R. J. Cook, "Alstonvilla," Woolvi, via Gympie
	D. E. and E. C. Apelt, "Thelmur," Oakey
	Mrs. I. M. James, "Kenmore" Stud, Cambooya
	H. L. Stark, "Florida," Kalbar
Large White	H. J. Franke and Sons, " Delvue " Stud, Cawdor
	Garrawin Stud Farm Pty. Ltd., 657 Sandgate road, Clayfield
	F. L. Hayward, " Curyo," Jandowae
	J. A. Heading, " Highfields," Murgon
	K. B. Jones, " Cefn " Stud, Pilton
	R. G. Koplick, " Melan Terez " Stud, Rochedale
	R. Postle, " Yarralla " Stud, Pittsworth
	E. C. Smith, " Smithfield " Stud, Coomera
	E. J. Bell, " Dorne " Stud, Chinchilla
	A. G. Fry, " Birubi " Stud, Dalby
	N. E. Meyers, Halpine Plantation, Kallangur
	L. C. Lobegeiger, " Bremer Valley " Stud, Moorang, via Rosewood
	J. H. G. Blakeney, " Talgai " Stud, Clifton

TESTED HERDS—continued.

Breed.	Owners Name and Address of Stud.
Large White—*continued*	V. P. McGoldrick, " Fairymeadow " Stud, Cooroy N. Woltmann and Sons, Wooroolin R. S. Powell, Kybong, via Gympie E. B. Horne, "Kalringal," Wooroolin S. T. Fowler, "Kenstan" Stud, Pittsworth J. A. and J. McNicol, "Camden," Canning Vale, Warwick
Tamworth	S. Kanowski, " Miecho " Stud, Pinelands N. R. Potter, " Actonvale " Stud, Wellcamp D. F. L. Skerman, " Waverley " Stud, Kaimkillenbun A. C. Fletcher, " Myola " Stud, Jimbour L. C. Lobegeiger, " Bremer Valley " Stud, Moorang, via Rosewood Salvation Army Home for Boys, Riverview F. Thomas, " Rosevale " Stud, Beaudesert A. J. Surman, Noble Road, Goodna P. V. McKewin, "Wattleglen" Stud, Goombungee Department of Agriculture and Stock, Regional Experiment Station, Kairi P. V. Campbell, Lawn Hill, Lamington E. C. Phillips, "Sunny View," M.S. 90, Kingaroy T. A. Stephen, "Withcott," Helidon W. F. Kajewski, "Glenroy" Stud, Glencoe
Wessex Saddleback ..	W. S. Douglas, " Greylight " Stud, Goombungee K. Day and P. Hunting, " Kazan " Stud, Goodna E. Sirrett, " Iona Vale " Stud, Kuraby C. R. Smith, " Belton Park " Stud, Nara H. H. Sellars, " Tabooba " Stud, Beaudesert H. Thomas, " Eurara " Stud, Beaudesert D. T. Law, Trouts Road, Aspley G. J. Wilson, " Glenbella " Stud, Silverleigh G. J. Cooper, "Cedar Glen", Yarraman J. B. Dunlop, Acacia Road, Kuraby

HAVE YOUR SEEDS TESTED FREE

The Department of Agriculture and Stock examines FREE OF CHARGE samples representing seed purchased by farmers for their own sowing.

The sample submitted should be representative of the bulk and a covering letter should be sent advising despatch of the sample.

MARK YOUR SAMPLE

Sample of .... seed
Drawn from .... bags
Representing a total of ....
Purchased from ....
Name and Address of Sender
Date......................

SIZE OF SAMPLE

Barley -	8 oz.	Oats -	8 oz.
Beans -	8 oz.	Peas -	8 oz.
Grasses	2 oz.	Sorghum	4 oz.
Lucerne	4 oz.	Sudan -	4 oz.
Millets	4 oz.	Wheat -	8 oz.

Vegetable Seeds - ½ oz.

SEND YOUR SAMPLE TO—**STANDARDS OFFICER, DEPARTMENT OF AGRICULTURE AND STOCK, BRISBANE.**

Milch Goats.

G. I. ALEXANDER, Cattle Husbandry Branch.

(Continued from June issue.)

GOAT'S MILK.

Goat's milk is almost pure white in colour and is comparatively rich, with a fat content of about 5 per cent. The fat globules are small in size and, being in a more perfect state of emulsion than in cow's milk, do not come to the surface of the milk on standing as readily as those of cow's milk. The curd of goat's milk forms into very small flakes which, being soluble, are readily digestible. These features allied with the goat's freedom from tuberculosis make it valuable for infants and invalids. Goat's milk has been used in cases of infantile eczema and pink disease.

Its composition varies considerably between animals. The following table gives a comparison between an average sample of goat's milk with other milks of average quality.

—	Goat.	Ewe.	Cow.	Human.
	Per cent.	Per cent.	Per cent.	Per cent.
Protein	4·06	5·37	3·3	·98
Butterfat	5·14	3·65	4·0	4·4
Sugar	5·28	5·46	5·0	6·9
Salts	0·58	0·79	0·60	0·45
Total Solids	15·06	15·27	13·18	12·02
Water	84·94	84·73	86·82	87·98

Good goats can give over a gallon a day and some goats produce far beyond this. The average goat kept under good conditions should yield about two quarts of milk daily over a period of seven to 10 months. Three pints a day is considered fair production. A study of the official test records compiled under the British Official Pure-Bred Milch Goat Production Recording Scheme shows that, over a lactation period of 273 days, the average goat under test gave a total of about 2,000 lb. of milk and about 80 lb. butterfat. This means a daily average of about six pints of milk. These are purebred goats and grade animals may not achieve such high production figures. For the householder a good goat is one which will give 800-1,000 lb. (400 quarts) in one lactation.

FEEDING OF MILCH GOATS.

Milch goats require good feed and management, as do other types of farm animals. They are selective feeders and require good quality feed for maximum growth and production.

The most economical feed is good quality pasture. A good pasture is a young leafy growth of grass and legume. As pasture matures, its feeding value decreases and when fed alone it provides a ration of low food value. If goats are not fed supplementary food while pastures are deficient, they will drop in production, lose condition, and ultimately dry off prematurely. Then even when the pasture does improve, it may be a matter of weeks before the does respond, if at all, to the improved feed. Supplementary feeding is therefore essential to maintain milk production.

Constituents of Feed.

Protein.—The protein content of rations is of supreme importance. Proteins are complex chemical groups containing a number of substances known as amino-acids. The proteins fed in the diet are broken down by the digestive processes and by the action of bacteria in the rumen. In the process they are reduced to their component amino-acids and these are then converted into other amino-acids and proteins which go to build up body tissues and muscle and produce milk.

Milking goats and growing kids require more protein in their diet than do bucks and dry stock.

Carbohydrates and Fats.—Carbohydrates and fats form the bulk of the food. They are the energy-producing constituents; they supply energy for movement and maintenance of body heat, and form body fats. They are also responsible for the butterfat and milk sugar (lactose) in the milk of the milch goat.

Fats yield about twice as much energy as carbohydrates. This accounts for the high energy value of foodstuffs, such as peanut meal and linseed meal, which contain relatively high proportions of fat. There is a minimum requirement of fat in the diet below which milk production will fall even though the energy requirements of the animal are met.

Fibre.—This is the coarse less digestible part of the plant, the percentage of which increases as the plant matures. Young green plants are low in fibre while old mature and dry plants contain a high percentage. Fibre has the important function of adding bulk to the diet. The normal processes of digestion in the animal are hindered if there is insufficient fibre. Some fibre is broken down in the rumen or paunch to supply a small part of the energy requirements of the goat.

Minerals.—Minerals are essential for normal growth and development. They are needed for the formation of bone, blood and other body tissues. Many minerals are essential to the goat but only a few are of general importance. These are phosphates, lime, and salt. Many soils, especially in the coastal areas, are deficient in phosphates, and so a deficiency of phosphate may occur in the stock on these areas. Salt and lime deficiencies may occur in hand-fed goats and it may be necessary to add supplements of salt and finely ground limestone or bonemeal.

High producing goats secrete more minerals in the milk at the peak of their production than they are able to absorb from the feed. During the later part of their lactation and in the dry period, the depleted mineral resources are replenished. Good feeding must be continued during the dry period to make available minerals to replenish body stores depleted during the previous lactation.

Vitamins.—Goats, being ruminants, are less likely to suffer from vitamin deficiency than many other animals. Vitamin A is essential to goats and a deficiency may occur in kids if they are deprived of the colostrum or first milk from their dam. Adults rarely suffer a vitamin A deficiency as they can store enough of the vitamin to tide them over any period of the year when it may be deficient or low in their diet. This is the only vitamin likely to be deficient under Queensland conditions.

Classification of Fodders.

Fodders are broadly classified into roughages and concentrates. Roughages are those foods, such as silage, hay, and mature pastures, which contain a relatively low percentage of energy food. There is no sharp dividing line between roughages and concentrates. Important fodders such as mill offals and feeds such as young green crops and pasture occupy intermediate positions between the two. However, when rationing, it is convenient to consider fodders as either roughages or concentrates.

Roughages.

Pasture.—Good pasture is the cheapest and best feed for goats. Paspalum is of higher food value than most Australian summer species, but, as it is affected by frosts, is particularly deficient during winter. Winter-growing species such as the rye-grasses, Toowoomba canary grass (*Phalaris tuberosa*), cocksfoot and white clover are suited for winter grazing. Grasses are constantly changing in chemical composition and so in food value. Young leafy grasses have a much higher food value than those with much stem and those which have commenced to flower or seed.

Lucerne hay.—Lucerne hay varies enormously in food value. As the main protein content of the feed is in the leaves, the amount of leaf is a good indication of the protein content. Good green colour also is an indication of high vitamin A content.

Pasture hay.—This varies widely in food value. First-class hay is obtained from young leafy stands containing a high proportion of clovers and in which the grasses have not fully flowered or seeded.

Oaten and wheaten hay.—These are low in protein when cut at the usual haying stage of "early milk" for wheat and "late dough" for oats, but are equal to lucerne hay in energy value.

Concentrates.

Maize.—Although goats are capable of grinding maize grain, it is better to feed it crushed. Yellow maize is high in vitamin A and fat.

Sorghum.—Sorghum grain is equal to maize in feeding value. It is rich in carbohydrate and relatively low in fibre. The seed is small and hard and should be fed crushed or cracked.

Oats.—With fewer food units per 100 lb. than wheat, maize, barley, or sorghum, bulkiness is the great advantage of oats and crushed oats help to make the concentrate mixture more "open" and attractive to the animal.

Wheat.—Wheat should be fed coarsely ground or crushed. It should be fed mixed with other grains as excessive quantities without other grains may cause bloat or scouring.

Peanut meal.—Peanut meal is high in protein and fairly high in fat and minerals. It is a very useful concentrate. In addition, its palatability makes it a very useful ingredient of a concentrate mixture.

Linseed meal.—Linseed meal is rich in fat and high in protein content. It may be used up to 25 per cent. of the concentrate mixture. It should be fed dry to prevent prussic acid formation.

Cottonseed meal.—This meal is rich in fat, protein, and food units and is highly palatable. It has a similar protein content to peanut meal.

Coconut meal.—High in fat, and moderately high in protein, coconut meal is another very palatable meal.

Meatmeal and blood meal.—These high-protein feeds can be very satisfactory but their lack of palatability presents a problem, especially with some brands of meatmeal. If the goats can be induced to eat them, they are a very useful source of the protein necessary for milk production.

Pollard.—Pollard is about one and a-half times as rich in protein as grain, but the food unit value is slightly lower. A palatable concentrate, it is quite satisfactory in mixtures or alone.

Bran.—Bran has about the same protein content as pollard, but is slightly lower in food units. The advantages of bran are its palatability, its beneficial "leavening" effect on the texture of the concentrate mixtures in which it is used, and its laxative effect.

Molasses.—This feed is fairly high in food unit value, being a concentrated solution of sugars, but has no digestible protein. It is of value in increasing the palatability of feed and may be used to render rather unpalatable mixtures more acceptable to the animal.

FODDER VALUES OF COMMONLY USED FODDERS.

—	Food Units (Starch Equivalent).	Digestible Crude Protein.
	Per 100 lb.	Per 100 lb.
Hay—		
Lucerne	35	12·0
Cereal	35	2·0
Protein-rich Concentrates—		
Blood Meal	60—70	65—70
Meatmeal	75—80	50—60
Peanut Meal	75—80	40
Cottonseed Meal	65—70	40
Linseed Meal	65—70	30
Coconut Meal	75	16
Carbohydrate-rich Concentrates—		
Maize Grain	75	10
Wheat Grain	70	10
Oat Grain	60	10
Sorghum Grain	75	10
Bran	55	12
Pollard	65	14
Molasses	50	..

Roughage Feeding.

The first essential in feeding the goat is to make sure that it gets adequate roughage. This means that it should have access to all the pasture it can eat. If the pasture is insufficient, other roughages should be allowed. Hay may be used; good quality legume hay is best, but cereal hays are quite suitable if supplemented by the right type of

concentrate. If available, silage is an excellent roughage feed. Free access to hay is probably the easiest way of giving the goat adequate roughage.

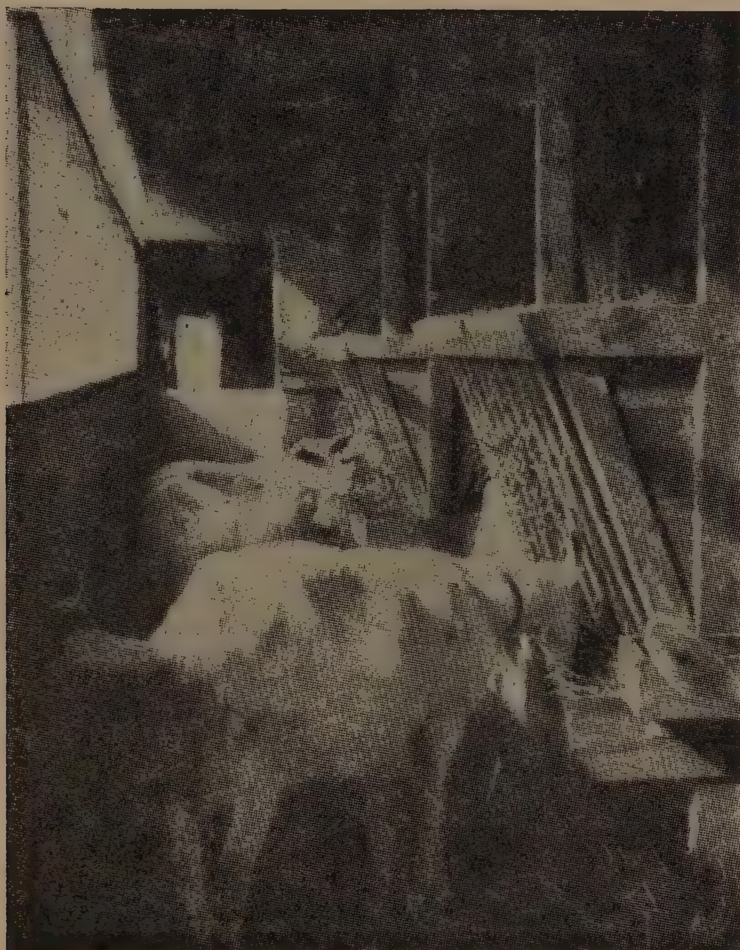

Plate 25.

Goats Feeding from Lucerne Hay Racks in a Barn.
[*Photo. by "New Zealand Farmer."*

The usual amount of dry roughage supplied is about 3-6 lb. daily, but an increased weight is required when feeding silage or green crops because of the water content of these feeds.

Concentrate Feeding.

When the roughage requirement of the milking goat has been satisfied, the concentrates to be fed must be considered. The type of concentrate to be fed is determined by a number of factors, of which the three important ones are—kind and quality of roughage; milk production of each goat; and cost of the various concentrate feeds.

The type of roughage fed governs the protein content of the concentrate mixture. If the roughage is good quality lucerne hay, lucerne chaff, young crops or young pasture, the concentrate mixture need only have 10-12 per cent. protein. This may be provided by grain alone or grain plus mill offals (bran and pollard). When the roughage is mixed with legume and cereal hay, mature green crops or good pasture, the concentrate mixture must have 14-16 per cent. protein. If the pasture is mature or cereal hay is provided, from 20-24 per cent. protein is required.

A mixture containing 10-12 per cent. protein is—

Crushed grain	1 part
Pollard or bran	3 parts

A mixture containing 14-16 per cent. protein is—

Crushed grain	3 parts
Pollard	1 part
Bran	1 part
Linseed meal	1 part

A mixture containing 20-24 per cent. protein is—

Crushed grain	3 parts
Bran	2 parts
Linseed meal	4 parts
or—	
Meatmeal	2 parts

In full hand-feeding is being carried out, the matter is simplified. Lucerne hay or chaff requires grain alone or grain plus mill offals. Cereal hay or chaff requires the mixture containing 20 per cent. protein.

Alternative rations are—

(*a*) For lucerne hay or chaff—

(i.)	Crushed grains	1 part
	Bran or pollard	3 parts
(ii.)	Crushed grain	4 parts
	Linseed meal	1 part
(iii.)	Crushed grain	9 parts
	Peanut meal	1 part

(*b*) For cereal hay or chaff (oaten or wheaten)—

(i.)	Crushed grain	3 parts
	Linseed meal	2 parts
(ii.)	Crushed grain	3 parts
	Peanut meal	1 part
(iii.)	Crushed grain	3 parts
	Bran	1 part
	Pollard	1 part
	Linseed meal	4 parts
(iv.)	Crushed grain	3 parts
	Meatmeal	1 part

The amount of concentrate to be fed to a milking doe depends on the amount of milk she produces. A pound of concentrate to each 4 lb. of milk produced is a good basis for feeding a milking goat. A close approximation of this is to feed 1 lb. of mixture per day for every three pints of milk produced. A minimum ration of 1 lb. of concentrate per head is desirable.

If good pasture is not available, dry and pregnant does may be fed about 1 to 1½ lb. daily of a ration such as—

Crushed grain	1 part
Crushed oats	1 part
or—	
Cracked grain	1 part
Bran or pollard	1 part

They should be maintained in a thrifty condition and not allowed to become too fat or to fall away excessively. Pasture or good quality hay may make up all the diet of dry animals, with grain fed just prior to parturition in order to prepare the doe for the following lactation.

The buck may be maintained in good thrifty condition on adequate good quality pasture. If there is insufficient, up to a pound daily of a concentrate mixture may be fed. Suitable concentrate mixtures would be:—

Cracked grain	8 parts
Bran	2 parts
Linseed meal	1 part

or—

Cracked grain	7 parts
Pollard	3 parts

REARING THE KID.

If the full supply of goat's milk is not required, the kid may be reared on the goat, allowing the kid the milk in one side of the udder or slightly less, depending on the production of the goat.

If the maximum of milk is required, the kid should be left on the doe for the first two or three days only in order to obtain the colostrum. Alternatively, the kid may be removed from the doe at kidding and fed the warm colostrum four times daily for the first two or three days. This may be done with an infant's feeding bottle. The kid may then be reared on ordinary warmed milk by bottle and gradually taught to drink from a dish. The milk should be warmed to body temperature and fed four times daily for the first three or four weeks, after which the number of feedings may be cut down to twice daily.

If maximum growth is desired, the kid should be fed as much milk as it will consume until about three months of age. Kids may be reared satisfactorily on separated cows' milk after about a fortnight. The change-over from whole to skim milk should be made gradually over about a week. The amount of milk required by a kid is about 1½ to 2 pints daily.

Kids should be encouraged to eat grain as early as possible and some whole grain or a mixture such as a calf meal should be made available after the first week to encourage the kid to nibble the grain. If the maximum amount of milk is required for domestic use, the kid may be weaned at about eight to 10 weeks provided it is fed some grain or meal. After about 3-4 months of age the feeding of the meal may be discontinued if good pasture is available.

MANAGEMENT OF THE BUCK.

The buck requires careful management. He should not be mated too soon or too frequently. With adequate feeding, a buck can be used at 10 months without fear of stunting his growth. The buck becomes sexually active at about six to seven months and should be segregated from the females before that age. A separate yard should be provided for the buck and the does in season should be brought in to him and removed after service.

Although the buck will not give very much trouble when running with the herd, this practice nevertheless has great disadvantages in

contamination of milk. The buck contaminates the doe with the odour associated with him at mating time and the milk may be tainted at milking time.

The yard in which the buck is run should be large enough to allow him plenty of exercise. If kept clean by fairly frequent washing, the buck will not have any objectionable odour. It is desirable that he be taught to lead and tie up so as to be handled easily.

MANAGEMENT OF THE DOE.

Goats may breed throughout the year but usually they come in season only during the period February-March to September. During this period they will come in season every two to three weeks if not mated. They usually stay in season for two to three days.

Goats will mate at six to seven months, but unless the young doe is well grown it is preferable not to mate it until 12-18 months of age. As the gestation period or duration of pregnancy is approximately 150 days, the doe will then be $1\frac{1}{2}$-2 years old when her first kids are born.

When a doe comes in season, she becomes very restless and will go off her feed. She will bleat persistently and frequently shake her tail rapidly. Usually the vulva swells considerably and becomes reddened.

Athough goats usually come in oestrus for two to three days, the period of oestrus may sometimes be quite short and last only a few hours, so careful attention must be paid to the doe when considering mating her.

The surest sign of pregnancy is absence of oestrus subsequent to service. If a doe is carefully watched for two to three weeks after mating and no sign of oestrus is seen, it may be assumed that she is pregnant.

The condition of the pregnant doe exerts a great influence on the weight of the kids at birth and also on the subsequent lactation. She should be fed well and allowed plenty of exercise.

The signs of approaching parturition are enlargement of the vulva, hollowing of the flanks, restlessness, and continual bleating. The udder usually hardens and springs before kidding.

At parturition there should be as little outside interference as possible. As goats are relatively free from trouble at kidding, assistance is seldom required.

The usual number of kids is two, but frequently there are three, and occasionally four kids.

After kidding, the doe immediately licks the kid dry and usually the kid will then begin to suckle the udder. The afterbirth usually comes away within one or two hours; should it be retained for more than 24 hours, a veterinary surgeon should be consulted.

The doe may be fed a bran mash after kidding. This has a laxative effect and to some extent assists the animal to clean. The bran mash may be prepared as follows:—To half a pound of bran and one teaspoonful of salt, add half a pint of boiling water. Cover the mixture with dry bran and then cover with a lid or cloth. The mash should be fed when cool. As mash sours readily, it should always be freshly prepared.

For the first three to five days after kidding, the milk, called colostrum or beastings, is unsuitable for human consumption. However, it is essential for the kids as it contains a high proportion of plasma proteins and vitamins which give the kids some measure of resistance to the diseases associated with young animals.

HERMAPHRODISM.

An hermaphrodite is an animal which has the genital organs of both sexes. This defect occurs in goats more than in any other domestic animal. The tendency to hermaphrodism is hereditary and appears to be associated with polled or hornless animals, as horned animals are not affected. There is apparently some heritable linkage between the polled character and hermaphrodism. This is more noticeable the more closely the animals are bred. If possible, one of the parents used in breeding goats should have (or have had) horns.

MILKING.

Milking may be done either from the side or from behind, depending on the milker's choice. However, it is preferable to milk from the side.

Before milking, the udder and teats should be thoroughly cleaned with a damp cloth, and it is of advantage to give the animal a quick groom to prevent hairs from falling into the bucket and causing odours in the milk. When milked out the udder should be small and elastic with no appearance of flabbiness. A big disability with "town-bred" goats is the small size of the teats. This does not occur with Saanen goats. Frequent milking tends to increase the yield, but two milkings in 24 hours spaced as evenly as possible are sufficient for average goats. Regularity and completeness of milking are big factors in keeping up the milk flow. A long lactation period is more important than the amount produced per day, and in purchasing animals this point should be borne in mind.

Care is necessary in milking, as rough handling may predispose to mastitis.

Machines for milking goats are available and are particularly useful where a number are milked daily. Using machines, it takes about two minutes to milk each goat. The machines must be carefully cleaned and tended and should be looked after in the same manner as milking machines for cows.

DEHORNING OR DISBUDDING.

There are two common methods of dehorning kids, namely chemical and cautery or hot iron.

Chemical Dehorning.

Caustic Sticks.—Kids up to 10 days old can be treated with caustic soda or caustic potash. Caustic soda has a tendency to spread and cause injury to surrounding tissues, so caustic potash is preferred.

Each "button" or horn bud is clipped to the size of a one shilling piece and then petroleum jelly is smeared outside the horn bud to check the caustic from running into the kid's eyes. The caustic stick is moistened and rubbed over the horn bud with a circular motion until blood just starts to seep through the spot.

The caustic should only be applied to the area of skin covering the horn bud. Too much caustic may cause excessive burning and scarring of the head; too little rubbing will leave unsightly scars.

Care should be taken not to get any caustic on clothing or skin, as it is very injurious.

Afterwards the kid should be tied up for at least six hours in a place where it cannot get wet. This is to prevent scratching, rubbing or wetting, which may spread the caustic.

Antimony Trichloride.—This product has been incorporated in a solution of flexible collodion to form a very satisfactory dehorning agent.

The solution can be made up by a chemist according to the following formula:—

	per cent.
Antimony trichloride	28
Salicylic acid	7
Flexible collodion	65

The material is easy to apply and dries readily. There is much less pain associated with this than with caustic sticks and no danger of fluid running into the eyes. The solution is painted on after the area of application has been cleaned with methylated spirits. The animal need not be tied up or kept out of the rain.

Cautery or Hot Iron.

This method of dehorning is simple, efficient, safe and only slightly painful. A special debudding iron is used for the operation. The iron consists of a solid cylinder of iron or copper five-eighths of an inch in diameter, one end of which is hollowed to form a depression three-eighths of an inch in diameter and half an inch deep. This makes the end of the cylinder a metal ring one-eighth of an inch thick with five-eighths of an inch external diameter and three-eighths of an inch internal diameter. The iron is mounted in a wooden handle for convenient use. The iron may be made smaller if required as it is intended to give a snug fit over the horns to be removed. A soldering iron may be converted fairly readily into an efficient dehorning iron.

The iron is heated to a cherry-red colour and placed over the horn. It is then turned completely around several times until the base of the horn is completely covered by a copper-coloured ring. This indicates that the circulation of blood to the horn has been destroyed. The operation takes 10-30 seconds and the horns drop off by themselves three to six weeks later. There is no haemorrhage, as the vessels are sealed by heat, and the wound produced is dry and clean, heals quickly and completely and cannot burn the dam's udder as caustic may do.

An electric soldering iron with a copper tip containing a hollow cone point similar to that described for the ordinary iron may be used if desired.

Older goats may be dehorned with cup dehorners as used for cattle. This operation is described in a leaflet on dehorning of cattle issued by the Department.

[TO BE CONTINUED.]

ASTRONOMICAL DATA FOR QUEENSLAND.

AUGUST.

Supplied by W. J. NEWELL, Hon. Secretary of the Astronomical Society of Queensland.

TIMES OF SUNRISE AND SUNSET.

At Brisbane.			MINUTES LATER THAN BRISBANE AT OTHER PLACES.					
Day.	Rise.	Set.	Place.	Rise.	Set.	Place.	Rise.	Set.
	a.m.	p.m.						
1	6.30	5.18	Cairns ..	18	40	Longreach	30	40
6	6.27	5.21	Charleville ..	25	29	Quilpie	36	34
11	6.23	5.23	Cloncurry	42	58	Rockhampton ..	5	15
16	6.19	5.26	Cunnamulla ..	30	28	Roma	16	18
21	6.14	5.28	Dirranbandi ..	21	17	Townsville ..	16	34
26	6.10	5.31	Emerald	14	24	Winton	34	46
31	6.04	5.33	Hughenden ..	27	43	Warwick	5	3

TIMES OF MOONRISE AND MOONSET.

At Brisbane.

Day.	Rise.	Set.
	p.m.	a.m.
1	12.15	1.44
2	1.11	2.49
3	2.16	3.53
4	3.26	4.53
5	4.40	5.46
6	5.52	6.33
7	7.01	7.14
8	8.08	7.51
9	9.12	8.26
10	10.16	9.01
11	11.19	9.36
12	..	10.14
	a.m.	
13	12.21	10.56
14	1.21	11.42
		p.m.
15	2.18	12.33
16	3.11	1.26
17	3.59	2.22
18	4.42	3.18
19	5.19	4.13
20	5.52	5.07
21	6.22	6.00
22	6.50	6.52
23	7.18	7.44
24	7.46	8.38
25	8.15	9.34
26	8.48	10.32
27	9.25	11.33
28	10.08	..
		a.m.
29	10.59	12.35
30	11.58	1.38
	p.m.	
31	1.05	2.38

MINUTES LATER THAN BRISBANE (SOUTHERN DISTRICTS).

Charleville 27; Cunnamulla 29; Dirranbandi 19;
Quilpie 35; Roma 17; Warwick 4.

MINUTES LATER THAN BRISBANE (CENTRAL DISTRICTS).

Day.	Emerald.		Longreach.		Rockhampton.		Winton.	
	Rise.	Set.	Rise.	Set.	Rise.	Set.	Rise.	Set.
1	30	10	45	25	20	0	53	28
6	24	13	41	28	16	3	47	31
11	13	25	28	41	3	16	31	48
16	9	30	25	45	0	21	26	53
21	15	22	30	38	6	13	35	44
26	25	12	42	27	17	2	49	30
31	30	9	45	24	20	0	53	26

MINUTES LATER THAN BRISBANE (NORTHERN DISTRICTS).

Day.	Cairns.		Cloncurry.		Hughenden.		Townsville.	
	Rise.	Set.	Rise.	Set.	Rise.	Set.	Rise.	Set.
1	54	5	67	34	51	20	44	6
3	55	2	68	32	51	17	45	3
5	47	7	63	35	47	21	39	8
7	36	19	55	43	40	28	30	17
9	24	31	46	52	31	37	21	27
11	13	43	39	59	24	45	12	36
13	8	52	36	65	21	50	8	44
15	2	56	33	67	17	53	3	46
17	5	52	35	65	19	50	5	44
19	11	45	38	60	23	46	10	37
21	20	36	43	55	28	40	17	31
23	29	26	50	47	35	33	25	22
25	40	15	57	41	42	26	33	14
27	48	7	63	35	48	21	40	8
29	55	4	68	33	51	19	45	5
31	54	3	67	32	51	18	44	4

Phases of the Moon.—Full Moon, 6th August, 5.40 a.m.; Last Quarter, 12th August, 11.27 p.m.; New Moon, 21st August, 1.20 a.m.; First Quarter, 28th August, 10.03 p.m.

On 15th August the sun will rise and set 15 degrees north of true east and true west respectively, and on the 8th and 23rd the moon will rise and set very close to true east and true west respectively.

Eclipses.—On 6th August there will be a partial eclipse of the moon, the moon entering the umbra of the earth's shadow at 4.33 a.m. and remaining within the umbra until after sunrise.

On 21st August, Eastern Australian Date, there will be an annular eclipse of the sun, but it will not be visible from Australia. The path of the annular phase is mostly over ocean, but portion passes over South America.

Mercury.—At the beginning of the month, in the constellation of Leo, will set about 1½ hours after the sun. By the 12th it will be in line with the sun, after which Mercury will pass into the morning sky, reaching greatest angle from the sun on the 30th, when it will rise about 1 hour before sunrise.

Venus.—Now a conspicuous object in the western evening sky. In the constellation of Leo, on the 1st it will set about ¾ hour after the sun, but by the end of the month, in the constellation of Virgo, it will set 1 hour 22 minutes after sunset. Venus will be near Mercury on the 4th and the moon will pass close to Venus on the 22nd.

Mars.—In the constellation of Libra, will set about midnight during this month. The moon will be close by on the 28th.

Jupiter.—In the constellation of Aries, will rise near midnight at the beginning of August and about 1 hour before midnight at the end of the month. The moon will pass Jupiter on the morning of the 12th.

Saturn.—At the beginning of the month, will set between 10 p.m. and 11.15 p.m., and at the end of the month will set between 8.15 p.m. and 9.30 p.m.

THE CONSTELLATIONS.

LYRA.

This constellation is said to represent the lyre that Hermes made from a tortoise shell and was given by Apollo to his son Orpheus, who played it to the Argonauts on their famous voyage. It is a small constellation directly to the west of Cygnus. Vega (Alpha) is the brightest star of the group and is an optical pair, the brighter component being 0.2 magnitude and the companion 10.5 magnitude separated by 56.4 seconds of arc. It is towards this part of the celestial sphere that our sun, with its "family" of planets, is moving with a velocity of about 13 miles per second. Beta Lyrae, about 6 degrees in the direction of Altair from Vega, is a well known eclipsing binary with a period of 12 days 22 hours. About 2 degrees from Vega in the direction of Alpha Cygni is the famous "double double," Epsilon Lyrae, one of the most striking objects in the sky. Acute eyesight will show this star as a double of about 4 and 5 magnitudes, but binoculars are needed to show them clearly. A small telescope, however, will show that both of these components are themselves double, one pair separated by 2.9 seconds of arc and the other pair by 2.3 seconds. Zeta, Delta and Eta are also doubles.

VULPECULA (THE FOX).

Situated to the east of Lyra and north of Delphinus and Sagitta, this constellation originally represented the Fox and the Goose. It is, however, a very inconspicuous group, consisting mostly of fifth magnitude stars. The famous Dumb-bell Nebula is situated in this constellation.

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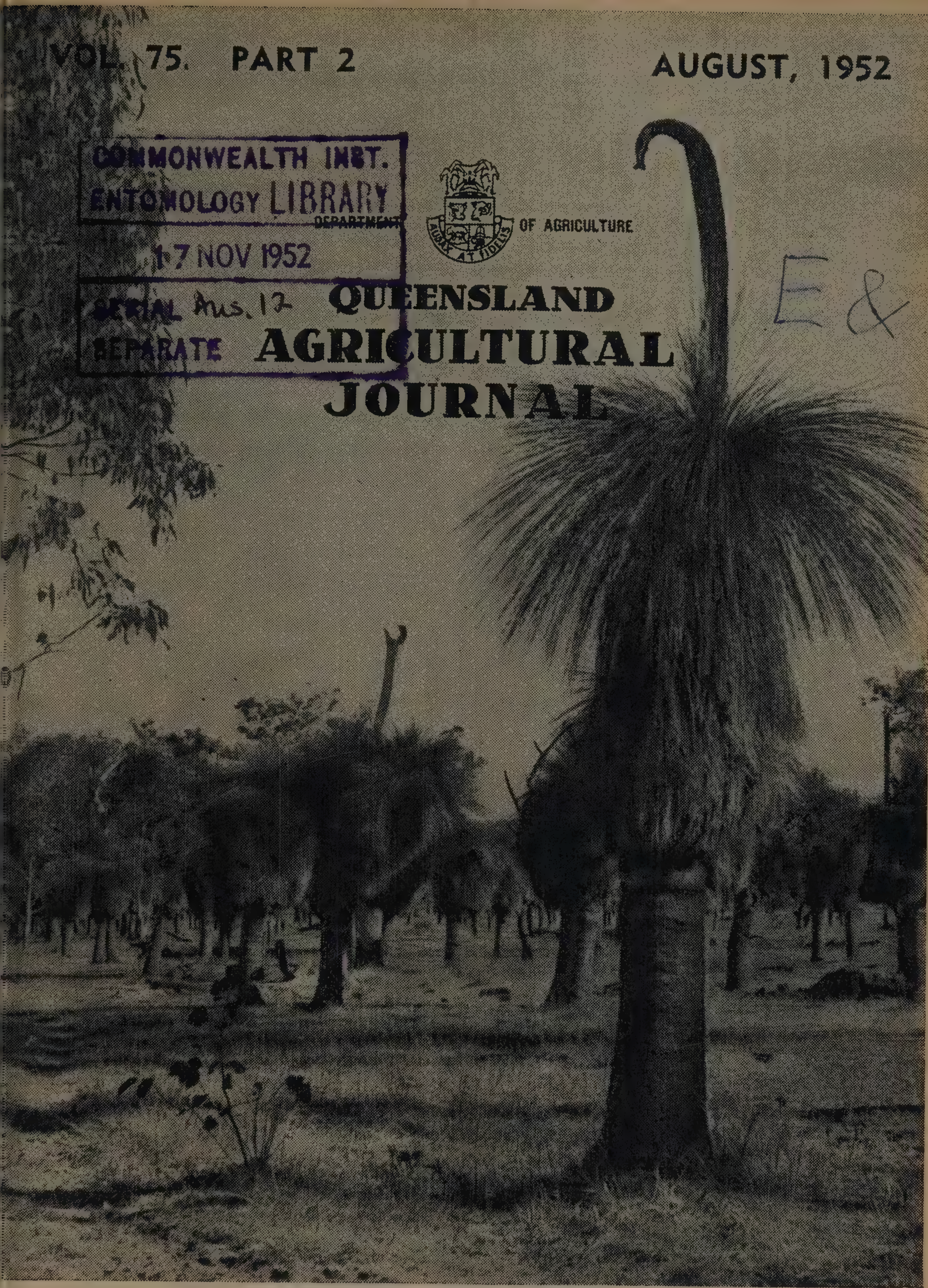

Grass-tree Country in the South Burnett.

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ROMA STREET . . . . BRISBANE

Tobacco Growing in South-western Queensland.

E. J. McDONALD, Adviser, Tobacco Culture.

AT the present time in Queensland, the tobacco growing industry along the Dumaresq River and Macintyre Brook (Plate 26) ranks next in importance to that of the Mareeba-Dimbulah area. Most of the tobacco is grown within a triangle of which the towns of Inglewood, Yelarbon and Texas form the points, with a small additional area at Riverton, upstream from Texas.

Tobacco has been grown in this area for more than 70 years. In the early days, varieties producing leaf suitable for air curing were grown, chiefly on fertile alluvial flats around Texas. With the change in consumer demands from pipe tobacco to cigarette tobacco, the industry declined, but it was revived with the introduction about 20 years ago of varieties producing leaf suitable for flue curing and for processing into cigarette tobacco.

At the present time there are more than 1,000 acres under tobacco. Production statistics for the seasons 1942-43 to 1950-51, as supplied by the Queensland Government Statistician, are shown in Table 1.

TABLE 1.

TOBACCO LEAF PRODUCTION IN THE SOUTH-WEST.

Season.	Total Acreage.	Total Production.	Average per Acre.
		Lb.	Lb.
1942–43	1,074	1,062,768	989·5
1943–44	871	686,112	787·7
1944–45	601	498,624	829·7
1945–46	641	583,968	911·0
1946–47	810	872,144	1,076·7
1947–48	582	402,864	692·2
1948–49	544	627,536	1,153·6
1949–50	758	822,100	1,084·6
1950–51	1,034	439,009	424·6
1951–52 (Estimate only)	1,270	1,300,000	1,040·0

Plate 26.

Sketch Map of the South-western District.

All tobacco is now grown with the aid of furrow irrigation on land adjacent to the two main streams. These are the Dumaresq River, which forms the boundary between Queensland and New South Wales in this region, and Macintyre Brook, which is one of the main tributaries of the Dumaresq River.

Practically all the land used for tobacco in this area is freehold and, in common with most cultivated land in Queensland, was originally used for grazing stock. A number of tobacco growers, however, have managed to purchase portions of land near the streams and establish their own farms.

A distinctive feature of the south-western tobacco growing area is that most of the crop is grown by sharefarmers both on large holdings and on small farms. The agreements under which sharefarmers operate differ widely, but commonly the land owner receives 25 per cent. of the net profits after selling expenses have been paid, in return for which he provides the land, buildings and equipment. The sharefarmer is responsible for the main expenses incurred in producing the leaf. At present, land suitable for tobacco growing is not readily available and the demand exceeds the supply of suitable land offered for sale.

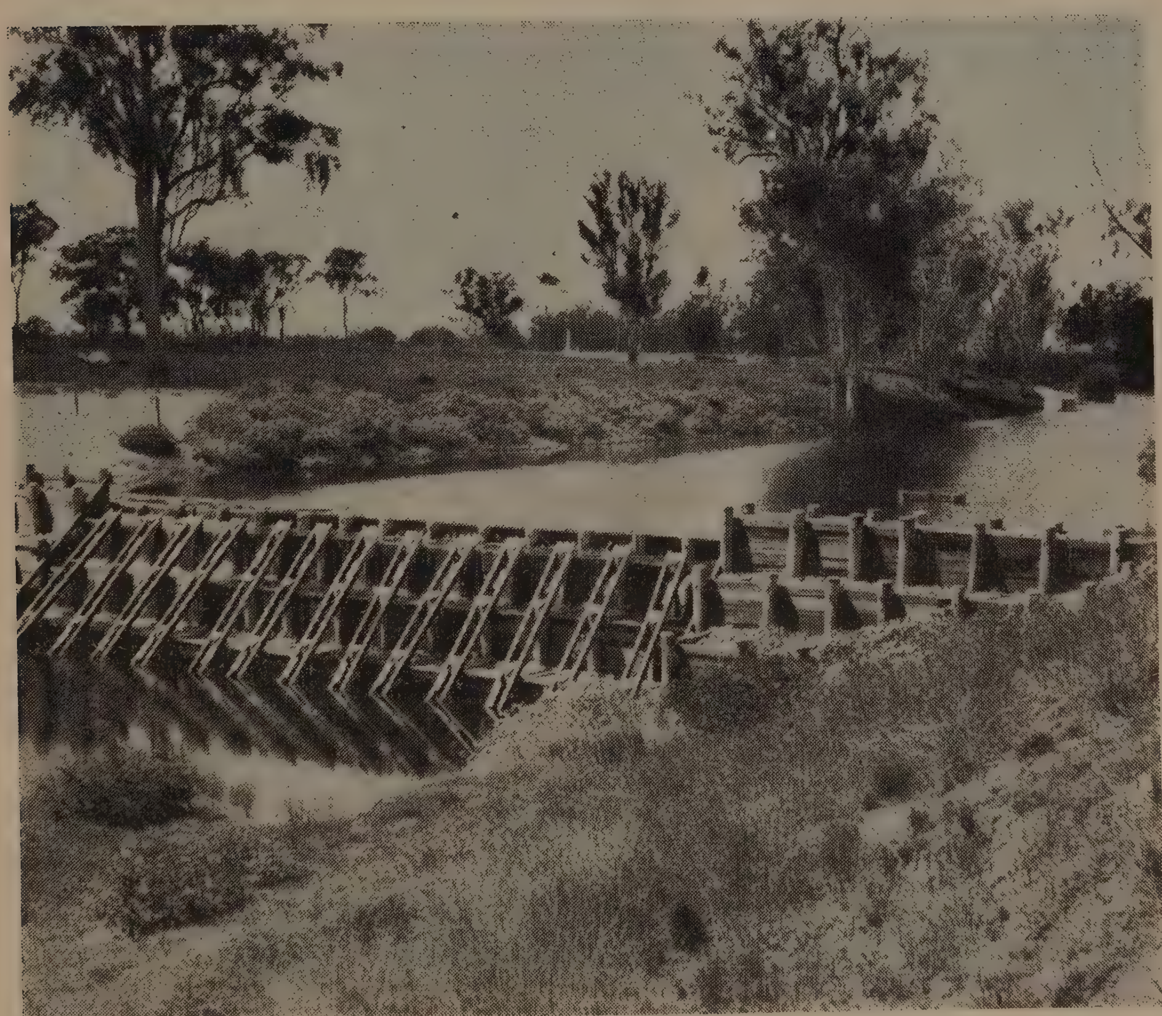

Plate 27.

Whetstone Weir on Macintyre Brook.

Plate 28.

Tobacco Farm, Wyemo, Dumaresq River, Showing Layout of Curing Barns and Other Buildings.

Plate 29.

Tobacco Farm, Glenarbon, Dumaresq River, Showing Grouping of Curing Barns and Bulk Sheds.

The usual area planted by each grower is from six to eight acres. Sharefarmers on each property or on nearby small farms commonly combine into groups at planting and harvesting periods and work from one tobacco block to another in rotation. For example, at planting, a group plants two acres for one grower, two acres for the next one and so on until two acres have been planted on all farms represented by the group. A further two acres are then planted on each farm in rotation and the process continued until the desired tobacco acreage for the season has been established on each farm. Harvesting and stringing of the leaf is arranged in a similar manner. Grower co-operation in this way has been very successful in meeting the problem of shortage of rural labour.

Plate 30.

Partly Harvested Crop of Tobacco, Wyemo, Dumaresq River, on Deep, Greyish-brown Sandy Loam.

Plate 31.

Tobacco Variety 400 at Yelarbon.

Plate 32.

Tobacco Farm on Macintyre Brook, near Inglewood. The harvesting of the tobacco crop in the foreground has been completed.

CLIMATE.

The district has an average annual rainfall of approximately 25 inches, most of which falls during the summer months. The average rainfall in points (based on 60-year records) for Inglewood and Texas is shown in the following table:—

District.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
Inglewood	318	271	253	124	164	178	177	123	156	212	266	310	2,552
Texas	344	252	216	133	145	186	184	130	150	211	238	305	2,494

Climatically the area is not as well suited as tobacco growing areas in North Queensland for the production of high quality tobacco. There are often considerable fluctuations of temperature during the growing period of the tobacco crop. After general rain in the summer months, the temperatures may become quite cool. These cool humid conditions favour the spread of blue mould in the growing plants, and almost every season crops in some portion of the area are affected by blue mould in the field.

Because of cool weather, planting in the field cannot take place safely before October. This means that harvesting is carried out in the wet summer months from January to March inclusive. Excessive rain during the late growing period favours disease outbreaks and is liable to lead to the development of heavy coarse leaf.

SOILS AND VEGETATION.

Land used for tobacco growing adjacent to the streams is reasonably level. In the virgin state, the country was grassed open forest. The main trees were eucalypts, principally ironbark and gums, with some patches of cypress pine on the sandier areas, while the grasses were native species.

The soils used for tobacco vary in texture, but the lighter types are more favoured. They occur most extensively on scattered alluvial flats along the Dumaresq River but are also represented on land adjacent to Macintyre Brook. They are grey-brown sandy loams and silt loams which usually merge into clay loams at a depth of about 10 to 12 inches. In some instances the clay loam subsoil may be at a greater depth and it is on soils of this type, particularly, that the production of high quality leaf is favoured.

Soils of a heavier texture are used to a lesser extent and are mainly confined to areas around Inglewood.

LAND PREPARATION.

Under the sharefarming system in operation, preparation of the land is usually performed by the owner. All farms are equipped with tractors, and as areas are small compared with those required for many other types of farming, land preparation is accomplished satisfactorily without difficulty.

Where virgin land is being brought into cultivation, clearing should be done as early as possible. The first ploughing should be done before the end of the summer prior to the season in which tobacco is to be planted. The land should then be left in a rough state to mellow before being worked up in the following spring.

The final ploughing in land preparation should not be deep. The land is then disc harrowed and levelled with a smoothing board. The latter operation is a very important one because small hollows in the field cause uneven growth of the tobacco plants, impede drainage in wet weather and add to the difficulties of irrigating efficiently.

FERTILIZERS.

Formerly, little fertilizer was used in growing the tobacco crop, but in recent years growers have become more conscious of the benefits accruing from correct fertilizer usage. As a rule fertilizer is not used on newly cultivated land, but on older cultivations an application of a complete fertilizer has been found to be profitable. The complete fertilizer commonly applied is a 2:17:4 mixture (2 per cent. nitrogen as nitrate of soda, 17 per cent. phosphoric acid as superphosphate and 4 per cent. potash as sulphate of potash) at the rate of 3-4 cwt. per acre. A fertilizer mixture containing more than 2 per cent. nitrogen is not desirable as the plants tend to grow coarse leaf which is slow to mature satisfactorily.

The loss of vigour in plants grown on old cultivations is due largely to deterioration of the physical condition of the soil, caused by the loss of soil structure as a result of cultivation, irrigation and depletion of organic matter. When this occurs the soil cakes and soil aeration is restricted. To overcome the problem of unthrifty plant growth on old cultivations, not only are fertilizer applications required but more attention needs to be given to crop rotation.

CROP ROTATION.

For the most part no definite system of crop rotation is followed. The growers usually plant tobacco on the same land for two or three successive seasons, then allow the old cultivation to return to weeds and grass for several years before cultivating it for tobacco again. This system is not a good one. If successive crops of tobacco are unavoidable it is recommended that the growers should at least adopt the practice of ploughing the land as soon as harvesting has been completed and sowing a winter cereal cover crop such as oats or wheat. This cover crop should be ploughed in six weeks or more before transplanting of seedlings into the field is due to commence. In this way, loss of physical condition of the soil is checked and weed growth is controlled.

On some farms, a crop of wheat for grain is planted following tobacco, before allowing the land to revert to weeds, but few growers plant cash crops other than tobacco. Although the tobacco-wheat rotation has been practised with success, it is considered that steady deterioration of the physical condition of the soil is inevitable if this system is followed indefinitely. It seems clear that the only way to maintain a desirable soil structure is to plant the land regularly to grass and leave it for two or three years before again breaking up for a tobacco crop. Experimental work at Miriam Vale, on the Lower Burdekin, and at Mareeba has shown that leaf quality and yield are very satisfactory when tobacco follows two years of Rhodes grass. A similar result can be anticipated on the tobacco land of south-western Queensland.

VARIETIES.

The variety known as Tabacon or Wyemo has been cultivated by many tobacco growers in south-western Queensland for a number of years. The variety yields heavily under good conditions but tends to produce a high percentage of leaf grades which are not favoured by buyers, particularly when grown on the heavier textured soil types. Tabacon is capable of giving some return even under adverse conditions and can produce good quality leaf on light soils. However, its tendency to produce coarse leaf of inferior quality is undesirable and the growing of this variety is not recommended.

The accent in tobacco leaf production should be on quality, and growers are advised to use varieties such as Gold Dollar, Virginia Bright Leaf, Mammoth Gold, 400, 401 and 402, all of which can give good yields of the better textured, higher quality leaf grades. Seed of these varieties may be obtained at a cost of 3s. per ounce on application to the Department of Agriculture and Stock, William Street, Brisbane.

SEED-BEDS AND SEEDLING PRODUCTION.

An adequate supply of healthy, vigorous seedlings is of primary importance in the successful production of a tobacco crop. Disease and pest free seedlings progress more rapidly in the field than defective plants and are essential for the growth of an evenly-maturing, high-yielding crop. Indifferent planting material is a serious handicap and should not be used. Therefore every operation connected with seed-beds should be carefully planned and carried out thoroughly.

Site.

Seed-beds require constant attention, so the site chosen should be convenient to the water supply. It should be fenced off and isolated from the home garden and any weedy areas which might harbour mosaic.

Protection from strong winds, which dry out the surface soil, is necessary. The seed-beds should not be shaded, particularly from the morning sun. The soil must be well drained and of good tilth. New land is very desirable, but if the use of old beds is unavoidable, the land should be ploughed as soon as the seedlings have been removed. A green manure crop should then be planted before using the site again for tobacco seedling production.

Area.

In calculating the seed-bed area, it is wise to allow not only for the number of seedlings required to plant the land to be cropped but also for a margin for mishaps and replacements in the field in the event of a bad strike. It is preferable to have an excess of strong, healthy seedlings than to be in a position where weak, diseased seedlings have to be used to complete planting in the field.

Sufficient seedlings to plant an acre and to meet all emergencies can be grown on 100 square feet of seed-bed.

Preparation.

As tobacco seed is very small, it is essential that the preparation of the seed-beds be thorough to reduce the surface soil to fine tilth. After ploughing and cross ploughing, the land should be cultivated several times before marking out the beds. These are then dug over, formed around the edges and raked to smooth out any depressions.

It has been customary to use seed-beds 60 feet long by 4 feet wide, but it is recommended that the more convenient size of 12 feet long by 4 feet wide be adopted. A different method of covering should also be used, the permanent edge boards and wire hoops over the bed being replaced by portable covers which can be removed from the bed as required.

The next stage after digging and smoothing is the burning of the beds. This is done to kill any harmful organisms which may cause disease, and to destroy insect pests, nematodes and weed seeds which may be present in the top layer of soil. To sterilize the soil to a depth of four inches, it is necessary to burn on the beds either a layer of wood nine inches deep, or a 4-inch layer of sawdust. As the soil will probably be dry, it should be watered a day or so before placing the wood or sawdust in position, because best results are obtained if the soil is moist but not saturated when burnt. If the beds are properly burnt, the soil should show a reddish tinge and be loose and friable.

After burning, any unburnt sawdust, wood and charcoal are raked off and the ashes are worked into the bed. The beds should not be dug over again, as unburnt soil with more disease organisms and weed seeds may be brought near the surface.

Seed-bed Fertilizers.

To improve soil structure and prevent hardening of the surface soil following frequent waterings, sheep or other animal manure may be spread on the tobacco beds and lightly dug into the top inch or two

of soil. The manure should be boiled in water for about 10 minutes before using, to kill any weed seeds or disease organisms that it may contain; otherwise much of the benefit gained from firing the beds will be lost.

Superphosphate at the rate of one pound per 12 feet by 4 feet seed-bed may also be added with the sheep manure. This fertilizer helps the seedlings to develop sturdy root systems.

Tobacco fertilizers are sometimes used in place of superphosphate on the beds and in general are more satisfactory. It is advisable, however, not to use a mixture containing dried blood for fertilizing seed-beds, as yellowing and stunted growth of the seedlings are liable to occur.

Precautions against Damping-off.

The disease known as damping-off occurs on some farms almost every season, so it is wise to take preventive measures. A day or so before sowing the seed, the beds should be watered with Cheshunt mixture. This is made by grinding separately copper sulphate (bluestone) and ammonium carbonate (rock ammonia), mixing these thoroughly in the proportions of 2 oz. of copper sulphate to 11 oz. of ammonium carbonate, and storing the mixture in a well stoppered bottle for at least 24 hours before using. This powder is then dissolved in water at the rate of two ounces to four gallons and applied to the bed by a watering can. The container should be properly rinsed with water after use to prevent corrosion.

Sowing the Seed.

Sowing the seed too thickly is a major cause of trouble in the seed-beds. Air and light are excluded, the plants become spindly, diseases are encouraged and insect pests find protection in the beds. One half of a teaspoon of seed is sufficient for each 50 square feet of bed.

The seed may be mixed with ashes or fine sand and distributed evenly over the surface of the bed. Alternatively, it may be stirred into half a can of water and watered on, care being taken to ensure that the water is kept well stirred so that the seed will not settle to the bottom of the can.

Some growers have obtained good results by partly germinating the seed in sand which is kept moist for five or six days. The germinating seed is then sown. The advantage claimed is that there is less risk of the seed-beds drying out before the seed completes germination, as seedlings appear within a few days of sowing. Despite this claim, however, experience has shown that a more even stand of seedlings can be obtained by sowing ungerminated seed.

The seed should be sown on a firm seed-bed and the soil then pressed with a flat board to bring the seed into contact with the soil. A light mulch of boiled manure or fairly coarse river sand may then be applied over the beds. This mulch will reduce evaporation of moisture, prevent the seed being washed, and protect it from ants.

Time to Sow.

Seedlings should always be kept growing steadily, as any check renders them less resistant to diseases. There is therefore no advantage to be gained by sowing the seed more than eight weeks before the land is ready for planting out. As the weather is rarely warm enough to enable transplanting in the field to be done with safety before the end of October or the beginning of November, the seed should not be sown before early September. When sowing takes place earlier, almost invariably water has to be withheld to prevent the plants from growing too large and at times the beds are kept so dry that vigour is seriously lowered before planting out is practicable.

Care of Seed-beds.

While the plants are small, their root system depends for moisture on the surface soil and care must be taken to prevent this from becoming dry. Watering may be necessary three times a day for the first few weeks. It is much better to give a number of light waterings each day than one heavy watering occasionally. As the plants grow, the waterings are reduced sufficiently to maintain steady growth.

If the plants do not appear to be growing satisfactorily, nitrate of soda dissolved in water at the rate of one ounce to four gallons may be applied before one of the daily waterings. Too much nitrate of soda or similar fertilizer, however, should not be applied, as it tends to promote soft growth.

Seed-bed Fumigation for Control of Blue Mould.

The most serious disease of tobacco seedlings in the seed-bed is blue mould, and precautions against it should be taken every season. Treatment with benzol gas has been proved to be very effective if properly applied. Growers should begin using benzol as soon as the leaves of the young plants are about the size of a threepence. Treatment earlier than this may be necessary if cool, showery weather prevails, as these conditions favour blue mould development.

It is definitely a bad practice to delay benzol treatment until blue mould appears on the seedlings.

The main points to be kept in mind when using benzol are:—(*a*) the covers on the beds should be as airtight as possible; (*b*) an adequate amount of benzol should be used; and (*c*) the benzol gas must be in contact with the plants for a sufficient length of time.

In the case of long seed-beds, sawn hardwood boards should be fitted to the edges and wire hoops placed across the beds; duck or calico is stretched over these hoops. Particular care must be taken to ensure that the covers are of good quality and fit neatly and tightly over the beds. Otherwise, airtight conditions over the seedlings are not obtained and the benzol gas is not then fully effective.

Where the recommended 12 feet by 4 feet beds are used, portable covers can be made. A suitable type is shown in Plate 33.

When the beds are first formed, a 2-inch thickness of sand is placed around the edge on which the frame sits. Cheesecloth is placed over the hip roof while the plants are small, but when benzol is to be used

this is replaced by calico. To do this, the cleats are unscrewed, the cheesecloth removed, calico stretched across, and the cleats replaced. If this job is done carefully, and all boards have smooth edges, a gastight cover will be made.

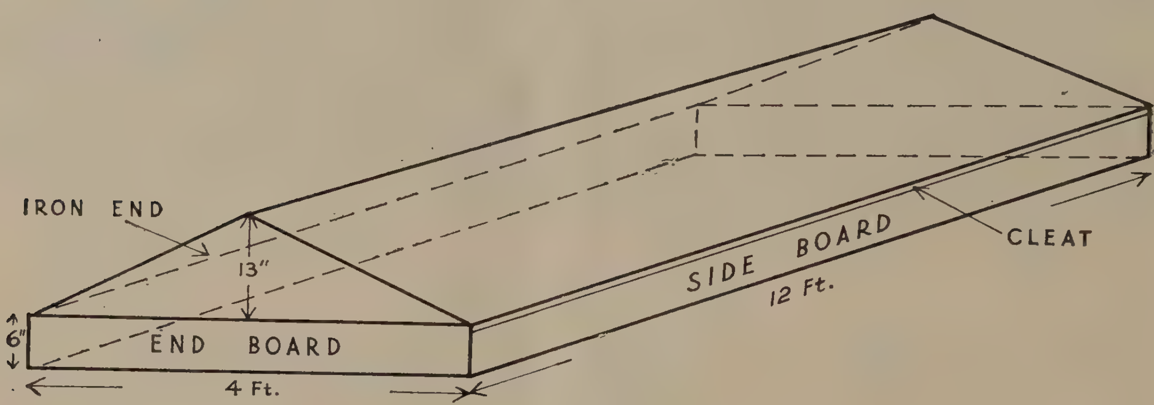

Plate 33.

Sketch of a Seed-bed Cover.

Plate 34.

Seed-beds at Whetstone, with Calico Covers Removed. Note the edges of the beds made of sawn timber.

In use, the cover is placed on the sand and shaken backwards and forwards a few times to settle it into the sand. Portable covers of this type are easy to handle, save time and labour and minimise the margin of error in the use of benzol. The frame can be raised vertically above the bed, thus retaining protection from rain while still allowing the seedlings to obtain light and air.

The cost of making a frame is small, as most of the materials can be found on every farm. With care, the framework will last many years, and as the calico is not handled every day its life is longer than similar material on large beds. At the end of the seed-bed operations the calico should be removed and the frame oiled and stored on a flat surface.

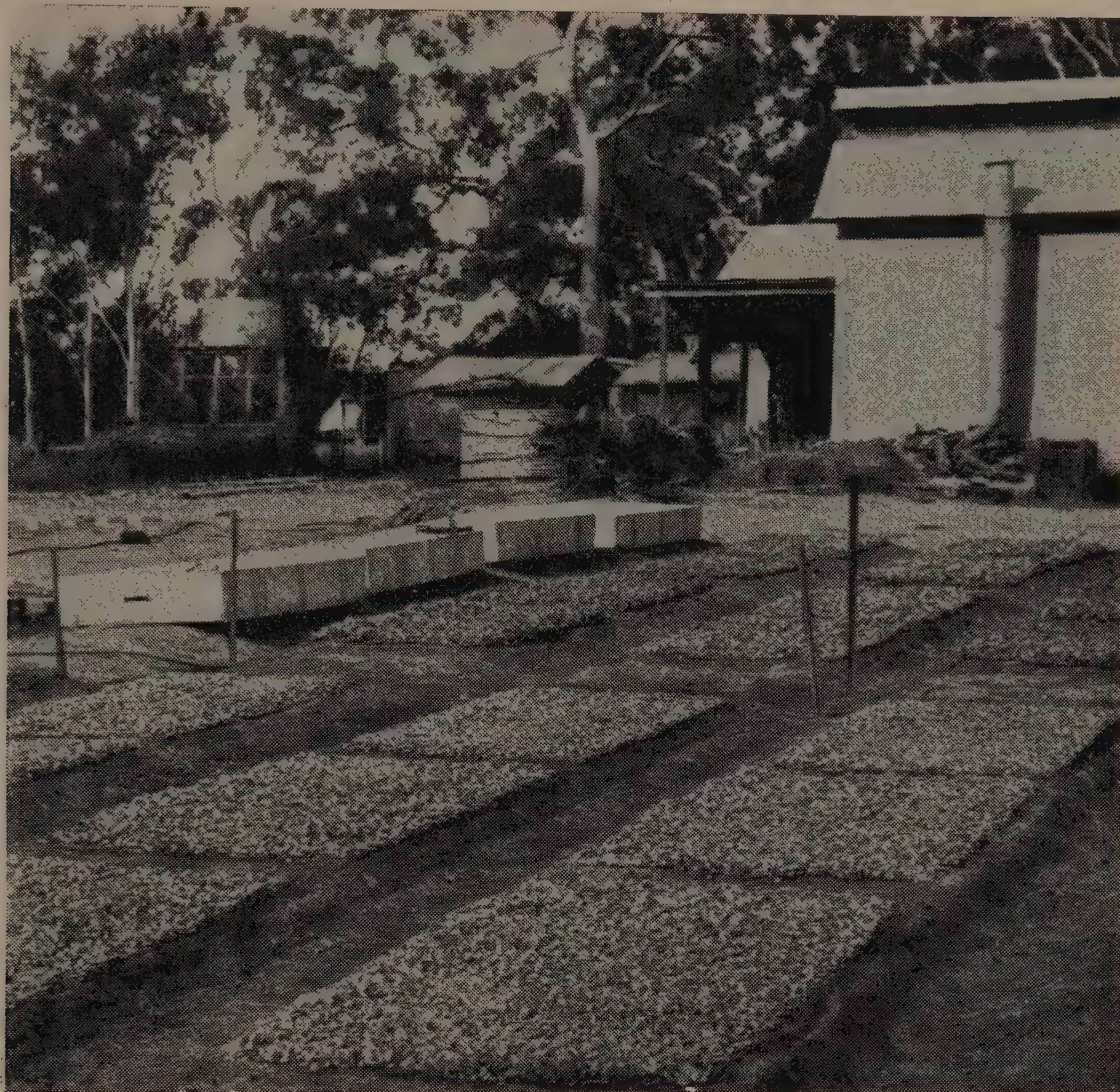

Plate 35.

Recommended Type of Seed-beds with Galvanized Iron Covers in Background.

Clare Tobacco Experiment Farm, Ayr.

The most satisfactory of the portable covers are those made of galvanized iron and shaped like a long, rectangular, shallow box about one foot high, with length and width dimensions to suit the size of bed to be treated (Plate 35). Up to the present, however, such covers have found little favour among tobacco growers in south-western Queensland. In general, cloth covers are not as efficient as the permanent galvanized iron types, which could be used with advantage more widely in this tobacco growing area.

Benzol liquid should be placed in shallow tins on small elevated stands at regular intervals along the middle line of the seed-bed to be treated, allowing one square inch of evaporating surface to each square foot of bed. The tins should be arranged so as to give even distribution of the benzol vapour within the enclosed area. As containers, empty meat tins are often used. However, these are not suitable as they have a small surface area compared with their depth and a large number have to be used to get effective fumigation. It is recommended that trays 5 in. by 5 in. by $1\frac{1}{2}$ in. deep be constructed from galvanized iron for this purpose. Two such containers would be needed for a 12 feet by 4 feet bed.

The trays must be filled with benzol and the airtight covers applied before 5 p.m., or earlier if the weather is cool, to permit evaporation before nightfall. For best results the gas should be left in contact with the seedlings for 12 to 14 hours. The covers should be removed in the early morning, remnants of the benzol in the tins removed and the beds then watered.

As already explained, benzol treatment should commence shortly after the seedlings appear above the ground. Because of the risk of frost injury, growers cover the beds each night and it is the common practice also to fumigate the beds each night with benzol.

Should damping-off disease appear in the seedlings, the Cheshunt mixture referred to earlier should be applied to check it.

Control of Seed-bed Insect Pests.

The principal insect pests of tobacco seed-beds are leaf miner and stem borer. These pests can be controlled by regular weekly sprayings with 0·1 per cent. DDT.

Before the plants are pulled from the beds they should be sprayed carefully with 0·1 per cent. DDT and lead arsenate (3 lb./50 gal.) spray to give the leaves a complete cover. This spray deposit will help to check insect attack for a short time after the seedlings have been transplanted into the field.

The area immediately around seed-beds should be kept completely free of weeds in order to eliminate any close harbourage for insect pests, such as brown vegetable weevil.

TRANSPLANTING.

When the plants are large enough and the risk of cold weather has passed, preparations for planting out in the field are made. Transplants should be sturdy, healthy and free of nematode swellings on the roots.

If fertilizer is being used, furrows are opened up and the fertilizer broadcast along the furrow, which is then closed in by making another furrow alongside the line of the original one. Fertilizer is applied by hand, usually from a bucket or similar container. Many growers improve on this method by fixing into one corner of the bottom of a sugar bag a length of light iron pipe about three feet long and tapering towards the point. The bag is filled with fertilizer, tied at the top, and slung over the shoulders. By inclining the pipe the fertilizer is made to run down into the furrow as the grower walks along. With a little practice, fertilizer can be distributed fairly evenly by this method at the desired rate per acre and the area to be fertilized can be covered more quickly than by other manual methods.

When fertilizer is not used, only one series of furrows is opened up. The furrows are spaced four feet apart and may be as deep as six inches.

Water is then run down the furrows (Plate 36), and as soon as it has soaked in the seedlings are planted (Plate 37) by pressing them into the wet soil at water level. Each planter carries his own plants in a half-kerosene tin and sets them out approximately 18 inches apart. Closer spacing is practised on the more fertile soil types.

The plants are generally irrigated on the following day, and then left for five or six days, unless very hot weather is experienced, in which case an additional watering may be required.

CULTIVATION AND IRRIGATION.

As soon as the young plants commence to grow, the hard soil crust which forms on the surface after irrigation should be broken up by cultivation. Further cultivations are given after each watering, and on each occasion some soil should be moved towards the plants to form,

Plate 36.

Furrow Irrigating Prior to Planting out at Inglewood.

Plate 37.

Planting out Tobacco Seedlings, Inglewood.

ultimately, a distinct ridge along the row. The practice of drilling out a furrow alongside the plants after each watering is undesirable. As the plants grow it becomes increasingly difficult to cultivate close to them, with the result that the hard surface soil crust around the bases of the plants then remains unbroken.

Plate 38.

Elevated Fluming Commonly Used to Carry Irrigation Water from the Dumaresq River to Tobacco Farms.

Plate 39.

Showing Siphon Method of Taking Irrigation Water from Elevated Fluming under Road.

The object of the irrigation procedure should be to move the water channel gradually from the bases of the plants. Finally, the water should run midway between the rows in a broad stream. By following this system the formation of a hard crust close to the plants is avoided and disturbance of plant roots is reduced to a minimum. Ridging assists the plants to withstand heavy winds and improves drainage. Furthermore, the water does not run so quickly, better penetration is obtained and fewer irrigations are needed. This last factor is important, as observations indicate that constant watering at short intervals tends to impair leaf quality.

The number of irrigations required to bring a crop through to maturity depends largely on climatic conditions. High temperatures, low rainfall and drying winds during the season make frequent irrigations necessary to avoid undue growth checks. Irrigation is usually given before each leaf harvest but over-watering should be avoided. Good ridging along the rows of the tobacco plants helps considerably in controlling water applications and in assisting drainage.

Elevated galvanized iron fluming is commonly used to convey water from the pumping site to the fields of irrigated tobacco on the higher river terraces (Plate 38). The fluming is supported by poles and is carried under roads by a U siphon system (Plate 39) where necessary. Fluming is cheaper than heavy piping. Moreover, with the reduction in friction head, a smaller engine can be used to drive the pump.

PRIMING.

Priming is the term applied to the operation of removing some of the lowest leaves of the tobacco plant. Its purpose is to assist in checking leaf diseases and in improving leaf quality. The small leaves touching the ground are removed when the plants in the field are about 18 inches high and a second priming may also be given at a later stage of plant maturity. Care must be exercised, particularly with the first priming, to ensure that mosaic disease is not spread throughout the field, if plants infected by this disease are present. Growers should avoid handling any plants showing mosaic infection and should avoid smoking while priming, as there is evidence that manufactured tobacco carries the mosaic virus. Leaf removed from the plants as a result of priming should be carried off the field and buried or burnt.

Priming is not commonly practised in the south-western tobacco-growing areas. Because of good prices, leaf which should be primed is harvested, cured and marketed, but low-quality leaf of this type is unlikely to continue to find a ready market.

TOPPING AND SUCKERING.

The practice of topping and suckering is important in successful tobacco production in the tobacco growing areas of south-western Queensland. On the comparatively fertile tobacco soils of this area, it is better to allow the flowers to develop before removal than to remove them too early. Generally, the best time to top is after one or two pickings of leaf have been made, but the operation should not be delayed beyond this stage.

The object of removing flower heads is to permit better development of the leaves. If flower heads are allowed to remain too long, plant foods are withheld from the top leaves, which are then frequently thin

and narrow at harvest. Furthermore, the flower heads may act as harbourages for insect pests which are liable to attack and destroy leaves at the tops of the plant.

When the plants are topped, sucker growth is stimulated. If the suckers are allowed to grow, the purpose of topping is defeated. Hence, they should be removed as soon as possible, except during periods of wet weather, when they can be allowed to grow for a short time to check the tendency of the leaves to develop a coarse texture under these weather condition.

INSECT PESTS AND DISEASES IN THE FIELD.

The main insect pests are those commonly found in all tobacco-growing areas in Queensland. They are discussed in detail in another article in this issue of the Journal.

The incidence of blue mould and mosaic diseases in the field will usually be low if the diseases are controlled in the seed-bed, unless weather conditions become favourable for the development of blue mould.

HARVESTING.

It is very important that leaf be ripe when it is harvested. The harvested leaf (for each barn) should be of uniform ripeness, otherwise it will not cure evenly and an inferior product will result.

Ripening begins at the base of the plant and progresses to the top. While ripeness is difficult to define clearly, the most obvious signs are the change in colour from green to yellowish-green and the whitening of the midrib, which loses its hairy appearance. In heavy, coarse-textured leaf, ripeness is often indicated by a yellowish-green mottling rather than by a complete change of colour in the whole leaf. Practical experience is necessary in order to ensure that only leaf at the correct stage of maturity is harvested.

Picking should be done in the cooler part of the day, and leaf should always be handled carefully to avoid bruising or breaking it.

The general practice is to place harvested leaf on hessian, which is then rolled up and carted to the stringing shed. On no account should excessive weight be placed on the leaf. For example, sitting on the load is a practice which should be prohibited.

STRINGING.

In the stringing shed, the leaf is spread on tables and is then strung onto sticks made of thin round bush timber or sawn sticks about one inch square. The stick is placed on a stand, and the leaves attached by means of string tied to one end of the stick and half-hitched around bundles of two to four leaves according to size. The tied bundles are placed alternately on each side of the stick along its length. When sufficient bundles are in position the string is tied to the far end of the stick, which is then ready to be placed in the curing barn.

FILLING THE BARN.

As most barns in the area are 16 feet square, very often it takes two days to fill each barn. When this happens, the leaf picked on the second day should be placed in the top of the barn, with the first day's picking underneath, as the latter will colour quicker than fresh leaf.

On many farms the first day's picking is allowed to remain on racks in the stringing shed until the second lot has been strung and placed in the barn. As a result of this practice the leaf is often subjected to cold winds and dries out too much. It is preferable to hang the first day's picking on the bottom tiers of the barn, leaving a space through which the next day's picking may be passed up to the top tiers. By having the barn closed no cold air is allowed to blow onto the leaf and a much more uniform cure results.

BARN TYPES.

By far the greater number of barns are made of cypress logs (Plate 40) and if used properly are quite satisfactory. New barns erected recently are of solid concrete, cement stucco, cement blocks, or sawn timber (Plates 41 and 42). In all types, the flues are at ground level and not in pits beneath the barn.

It is considered that the barns would be greatly improved by altering the system of bottom ventilation. At present, most bottom ventilators are merely holes in the walls, which are regulated by moving a wooden cover. Cold air thus blows straight into the barn. If the air were introduced to the barn by digging small pits outside the wall, and bringing it underneath and against flue pipes, a much better circulation of air and a more uniform temperature in the barn would be obtained, as the air current would not be direct and would be warmed before coming in contact with the leaf.

Plate 40.
Tobacco Curing Barns Built of Cypress Logs at Inglewood.

Top ventilators can be improved by attaching wires which would enable them to be regulated without going onto the top of the barn. The practice of climbing up the corners of barns to attend to the top ventilators is, if not dangerous, most inconvenient.

Plugging of holes in between the logs of cypress log barns with mud or cement to prevent air leaks is most necessary and frequent inspections should be made to locate holes or cracks which require plugging.

Plate 41.

New Tobacco Curing Barns and Bulk Shed, Glenarbon, Dumaresq River.

Plate 42.

New Tobacco Curing Barns Built of Sawn Cypress Timber. Old-type log barns are shown in the background.

CURING.

No set rules can be laid down for curing leaf. With each barn the grower has to consider the maturity of the leaf, the position on the plant of each lot of leaf, the texture of the leaf, and the atmospheric conditions likely to be experienced during the curing. Hence the times taken for the process and the ventilation required will probably vary a great deal. New growers are advised to obtain experience with established growers before attempting to cure tobacco in barns on their own.

Certain definite changes occur in the leaf during curing, and these are easily observed. The following table summarises the general procedure to be followed in operating a tobacco curing barn:—

Raise Temperature of Barn to—	Top Ventilator.	Bottom Ventilator.	Remarks.
90°–100°F. ..	Closed ..	Closed ..	Hold at this temperature until three-quarters of leaf is yellow
105°F. ..	¼ open ..	Closed ..	Hold at this temperature for approximately three hours
110°F. ..	½ open ..	¼ open ..	Hold at this temperature until most of green has disappeared and tips of leaves curl upwards
115°F. ..	¾ open ..	½ open ..	Hold at this temperature until edges of leaves curl inwards
120°F. ..	Full open ..	¾ to full open	Hold at this temperature until web of leaf on bottom tier is dry
125°F. ..	Full open ..	¾ to full open	Hold at this temperature until web of leaf on second tier is dry
Slowly raise to 140°F.	½ open ..	¼ open ..	Hold at this temperature until web of leaf on top tier is dry
Raise to 170°F. at rate of 5°F. per hour	¼ open ..	⅛ open ..	Hold at this temperature until midribs are dry

Some of the points which have to be observed in obtaining successful cures are:—

(1) To cure properly, leaf must be ripe and of uniform type and texture.
(2) Sticks and barns should not be overloaded.
(3) Curing should not be hurried, and regular attention must be given to avoid sudden fluctuations in temperature.
(4) In windy weather, bottom ventilation on the windy side should be decreased.
(5) In wet weather, bottom ventilation should be decreased and top ventilation increased.
(6) Late in the season, less ventilation is needed.
(7) Top ventilators should not be closed entirely at high tempertures, particularly when there is some green leaf in the barn.
(8) With heavy bodied leaf, curing is slower than with light leaf.

BULKING.

Tobacco leaf should be placed in heaps or bulks in a shed for some weeks after curing and prior to marketing in order to improve its appearance and quality. The leaf should be in correct condition before bulking—that is, it should not be too dry or too moist. If too dry the leaves break when handled, and if too moist there is danger of mould developing in the bulk. Practical experience is necessary in learning to judge the correct degree of condition.

The shed used for bulking should be of sound construction and weatherproof, with a floor raised well clear of the ground. Strong light should be excluded.

When bulking, leaf from each cure should be kept separate by the use of sheets of paper. This makes grading easier, as practically all leaf in any one curing will be from a similar position on the plant. Periodical inspections of the bulks should be made; if heating or mouldy odours are detected the bulks should be broken down and the leaves shaken and lightly aired before being rebulked. In any case, it is advisable to turn bulks at least once.

GRADING.

The object of grading is to collect together all leaf of the same type and quality. On the auction floors buyers can then bid with confidence in the knowledge that leaf from each lot bought can be used for a definite purpose.

The number of grades to be made will vary from crop to crop and with each season, and, in addition, the grading depends largely upon the judgment and skill of the individual graders. The grading shed should be enclosed to keep out wind, and adequate light should be provided above and behind the graders so that they may see the leaf clearly, without shadows or direct rays of the sun on it.

The leaf is sorted according to texture, colour, size and freedom from damage. When each leaf is picked up, the grader, by feeling it, decides its texture—that is, whether it is harsh, good bodied, thin bodied or papery. This is the most important point to be determined. There are six colour groups into which leaf is classified—bright, bright mahogany, mahogany, dark mahogany, dark, and green. Size of leaf falls into large, medium, and small. Lastly, an assessment is made of damage to the leaf from hail, insects or mould, which reduces the proportion of leaf web to midrib.

Some growers have tried to grade mainly on colour, but this is not a reliable method, as several distinct types of leaf can be of similar colour but vary greatly in other respects. Such types when grouped together may present a very variable and unsatisfactory sample.

BALING FOR MARKET.

After the leaf has been graded it is tied into "hands" before baling for market. To make a "hand," sufficient leaves of one grade are bound together with a leaf of the same grade to form a bundle with a butt between one inch and $1\frac{1}{4}$ inches in diameter. The "hand" should be tied tightly and neatly by passing the binder leaf twice around the butt to about $1\frac{1}{2}$ inches down the stems, opening the hand in the centre and pulling the end of the binder through.

As in the case of bulking, the main factor to watch when baling is the condition of the leaf. Excessive moisture tends to stimulate mould development, which will seriously reduce the value of baled tobacco. Therefore the leaf should contain just sufficient moisture to enable it to be handled without breaking. Only leaf of the same grade should be included in each bale. The bale should be well packed, the hands being placed neatly side by side with the butts outwards to each end.

Bales should be of a convenient weight and size. A bale weighing about 160 lb. and measuring about 36 inches by 22 inches by 18 inches is suitable. Such a bale is not liable to damage in transit, the leaf is not over-pressed, and the bale opens up attractively for display on the auction floor.

PLANT PROTECTION

Tobacco Pests in Queensland.

W. A. SMITH, Entomologist, Science Branch.

THE tobacco grower has to contend with insects which attack roots, stems, and leaves of the growing plants and the cured leaf in the farm bulk shed. Some of these pests are usually present on most farms every year, **and even on new farms it is almost impossible to grow a payable crop without the use of insecticides.**

The pests discussed here are more particularly those of the northern and coastal areas of Queensland, but most of them also may occur in tobacco in other parts of the State. Major pests in the field are discussed individually in detail, but control in seed-beds is dealt with separately in the relevant section.

MAJOR FIELD PESTS.

Tobacco Loopers.

Two species of loopers*† have been recorded as pests of tobacco. The common name is derived from the way the bodies of the larvae or caterpillars are arched or looped in moving. Leaves are eaten by all stages of the larvae and when large populations are present only the stems and larger leaf ribs remain. More usually the plants are left in a ragged condition, particularly the bottom and middle leaves.

During the past few years only the native species* has been found damaging tobacco and this is described below.

Life History and Habits.

The pearly white eggs are slightly flattened and round in outline with a diameter of about one-fortieth of an inch. They are laid singly. It is common to find two or three eggs on the underside of the larger leaves, but eggs may be found on any part of the plant in smaller or larger numbers.

After an incubation period of five days the larva emerges from the egg and commences feeding on the tobacco leaf. It is a thin, watery-white grub about one-eighth of an inch long with a black head and prominent black body hairs. After some leaf has been eaten the body becomes tinged with green. In this stage the grub eats the leaf from the lower side in holes one-eighth of an inch or less in diameter, and the transparent upper epidermis is left intact. After four or five days the larva casts its skin and enlarges slightly. The head of this (and of later stages also) is pale or light green and the body hairs are less noticeable. Two or three days later the looper again casts its skin and enters the third stage, when it attains the typical looper shape and colour. There may be as many as seven larval stages and the average time taken from hatching of the egg until the larva is full-grown is 27 days.

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* *Plusia argentifera* Gn.

† *Plusia chalcites* (Esp.).

When full-grown the looper caterpillar is about 1¼ inches long when at rest, but is capable of extending its body when searching for a foothold with the front legs. The forepart of the body is narrow, the rear segments are broader, and the general leaf-green colour is broken by two white stripes along the back and by other variable white markings. Occasional specimens have prominent black spots on each body segment at the bases of body hairs. Because they do not eat, unhealthy or poisoned loopers fade to a light yellow. The looper differs from all other tobacco leaf eating grubs in having only two pairs instead of four pairs of ''false'' legs towards the rear of the body.

The fully-fed larva selects a sheltered site in a fold beneath a leaf, near a leaf junction or beneath debris on the surface of the soil. There it forms a webbed covering and remains inactive for two days before changing to a pupa. About 10 days later the moth emerges from the pupal shell, pushes its way through one side of the webbing, and rests for a time before flying off. It is predominantly bronze-brown in colour, three-quarters of an inch long when at rest with folded wings, and 1¼ inches across the expanded wings. The forewings bear small but prominent silver-white marks. Moths shelter in the tobacco or adjacent weeds by day, and after mating, lay eggs on the tobacco at night. Under laboratory conditions more than 100 fertile eggs have been laid by one specimen in 48 hours.

Seasonal Behaviour.

Eggs are usually deposited on tobacco during the first two weeks after planting out. On September planted crops, therefore, well grown grubs may be active late in that month or during early October. Following this activity there is normally a lull, to be followed by heavy feeding by larvae of the next generation in either November or December. A further population peak in summer is rare. This seasonal sequence and the intensity of attacks will vary with temperature and rainfall. No definite information on the behaviour of the species between February and July can be given, but most likely there is a continual but slow breeding of small numbers on other host plants, chief of which are tomato, potato and a wild tobacco*.

The second looper species has been bred from tobacco, cabbage, coleus, tomato and a wild tobacco*.

Control.

An insecticide application to be of value against loopers must kill a high percentage of the population, kill quickly and preferably remain effective for some time. On rapidly growing plants it may need to be applied frequently to cover new growth, and regular applications are also necessary where spray irrigation is practised, as this shortens the persistence of insecticide residues. Either a spray or a dust may be used, and although dusts are usually easier to apply, the results from comparative trials have favoured sprays. Complete cover should be the objective—that is, both sides of each leaf should receive a film of insecticide.

Table 1 summarises results which may be expected with various insecticides when correctly applied against the loopers. There is strong evidence that BHC, chlordane and toxaphene when used as sprays applied to the leaves may cause undesirable taints in tobacco.

* *Nicotiana glauca* Grah.

These materials have no outstanding attributes for controlling stem and leaf pests and therefore should not be used for these purposes in Queensland tobacco fields.

TABLE 1.

RESULTS TO BE EXPECTED WITH INSECTICIDES AGAINST LOOPERS.

Insecticide.	Strength of Active Ingredient.	Percentage Kill.	Quickness of Action.	Effective Persistence.
			Days.	Days.
DDT Emulsion	0·2 per cent. ..	65	1	7
DDT Emulsion .. .. plus Lead Arsenate ..	0·2 per cent. .. 3 lb./50 gal.	90–95	2	7–9
DDT Emulsion .. .. plus Lead Arsenate ..	0·1 per cent. .. 3 lb./50 gal. ..	90–95	2	7–9
Lead Arsenate	3 lb./50 gal. ..	80	2	7–9
* BHC Miscible Oil ..	0·03 per cent. gamma isomer	90	2	3–4
* DDT Emulsion .. plus BHC Miscible Oil	0·1 per cent. .. 0·03 per cent. gamma isomer	90–95	1–2	7
Dieldrin Emulsion ..	0·05 per cent. ..	90	2	7–9
Dieldrin Emulsion ..	0·1 per cent. ..	95–100	1–2	10–11
* Toxaphene	0·1 per cent. ..	90–95	1–2	7
* Chlordane	0·1 per cent. ..	65	1–2	5
E.605	0·01 per cent. ..	70	1–2	4–5
E.605	0·05 per cent. ..	80	1–2	4–5

* May taint the cured tobacco leaf.

Plate 43.

A Tobacco Leaf Being Damaged by Looper Caterpillars. Bran bait applied against budworm is present towards the bottom of the leaf.

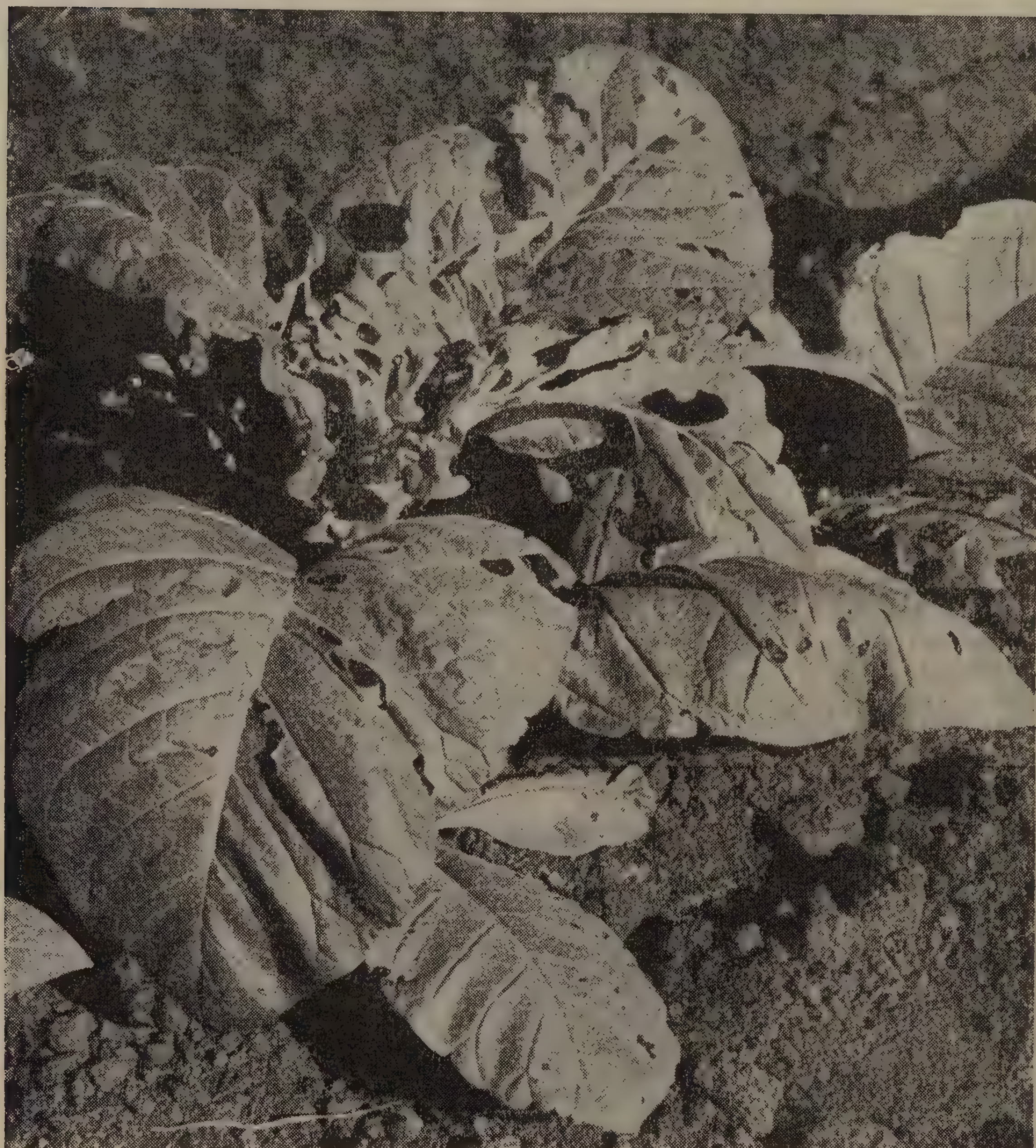

Plate 44.

A Tobacco Plant Damaged by Budworm and Looper Caterpillar. A recent application of bran bait is also shown.

Plate 45.

A Full-grown Tobacco Looper Caterpillar.

In the seed-bed and until the plant is about 18 inches high the problems of undesirable insecticide residues and taint do not arise. Later, however, heavy residues of stable poisons (such as lead arsenate) and residues which may cause leaf taint must be considered. Applications of such insecticides to control the looper outbreaks in November-December, which may occur close to harvesting, must be made carefully and sparingly. Frequent close inspections will ensure early recognition of looper hatchings, and an appreciable reduction in their numbers can be achieved by priming the lower leaves carrying the bulk of infestation. A light insecticide application immediately afterwards will then have a greater chance of preventing heavy damage.

Plate 46.

Moths of the Budworm (top) and the Cluster Grub.

Plate 47.

Moths of the Tobacco Looper Caterpillars. Top, *Plusia argentifera* Gn.
Bottom, *Plusia chalcites* (Esp.).

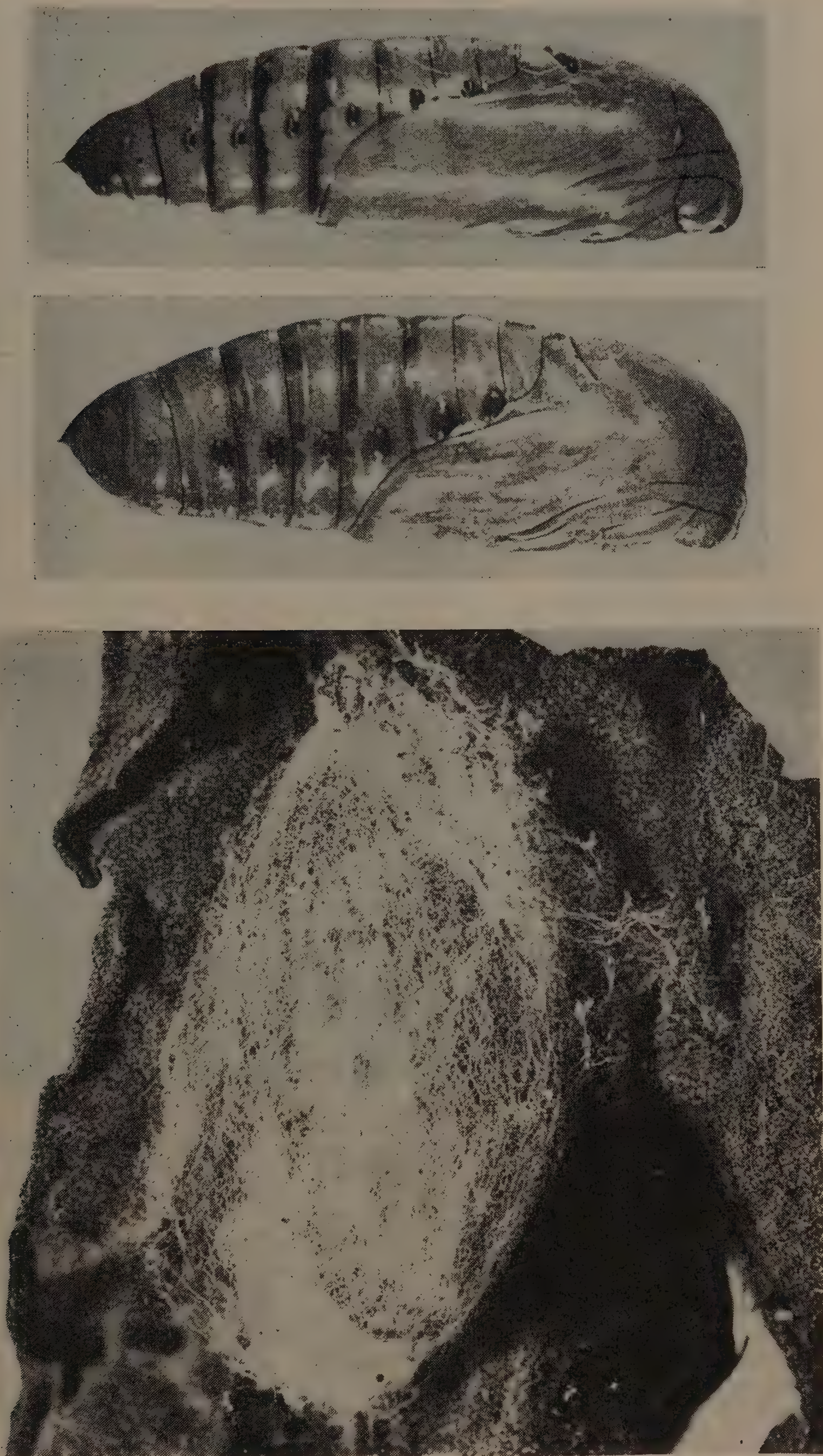

Plate 48.
Pupae of Tobacco Leaf-eating Caterpillars. Top, budworm. Centre, cluster grub. Bottom, looper.

Plate 49.

Eggs of the Budworm Moth on a Tobacco Inflorescence. The inset shows part of a tobacco flower with eggs attached.

Tobacco Budworm.*

This pest is well known in Queensland on a variety of weeds and crops other than tobacco, and depending on the crop attacked it is called corn ear worm, Heliothis caterpillar or tomato grub. The name tobacco budworm is derived from its habit on this crop of eating the buds or growing terminals. While feeding can occur on any of the leaves of either seedlings or field plants, the damage to the growing terminals, with consequent promotion of sucker growth before flowering, is much more serious.

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* *Heliothis armigera* (Hb.).

Life History and Habits.

The globular egg is slightly smaller in diameter than that of the looper and is pearly-white in colour, with brown marks appearing before hatching. The newly hatched larva is watery-white and thicker in the body than the looper. In five or six growth stages taking up to three weeks the caterpillar gradually acquires more body colour and the body hairs become more pronounced. The full-grown larva measures about 1½ inches, and has a colour pattern in which green, brown or black may predominate. It finally burrows three or four inches into the soil near the base of the plant, forms a smooth-walled chamber and pupates. After 10 days or longer the rather drab light-brown moth with indistinct black markings leaves the pupal cell.

Budworm may be found in August seed-beds and large populations frequently occur two or three weeks after planting in the field. From then on the seasonal life history is not consistently well defined, but several periods of marked activity can be expected through the cropping season, even on very late planted crops.

Control.

Budworm is more readily killed by DDT or lead arsenate sprays or dusts than is the looper caterpillar. However, the feeding preference shown for the terminal growth of this rapidly growing crop means that insecticides have to be applied, at least to terminals, at about weekly intervals while the danger of budworm attack is present. Once the larva has entered the protection of the bud leaves, it is able to do considerable damage in a short time.

As well as spraying and dusting, baiting can be used successfully for budworm control, particularly after the final machine cultivation. A bait of lead arsenate mixed with dry bran or pollard (page 103) may be lightly sprinkled by hand and allowed to trickle into the heart of the terminal and down the stem, to collect at the base of the leaves. Very little material is required, and hand application is fairly rapid. If the bait is used at a heavy rate and thrown over the leaf surfaces in an attempt to control looper as well as budworm, some leaf blemish results from moulds growing on the bran or pollard. A better alternative would be to use a hand duster and apply lead arsenate as a dust.

Some of the newer insecticides, including dieldrin, will also control budworm, but the same limitation exists as with lead arsenate and DDT.

Cluster Caterpillar.

The cluster caterpillar* is usually of less importance than either looper or budworm. Although hatching of the young caterpillars occurs in "clusters" of more than a hundred, the natural mortality rate on tobacco is high. The larvae eat leaf tissue in much the same way as the looper, but the large numbers of young larvae present may completely destroy one or two leaves on a plant before the survivors migrate to other leaves or other plants.

This pest can be present in August seed-beds and at any time later in the crop, but it is more noticeable from December onwards.

Alternate hosts of the cluster caterpillar are cabbage, tomato, cotton and numerous weeds.

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* *Prodenia litura* (F.).

Life History and Habits.

More than a hundred eggs are laid on the leaf in an irregular compact group covered with light-brown hairs from the abdomen of the moth. The flat egg cluster is roughly oval and about half an inch long. The larvae, which in the smaller stages are broadest near the front three pairs of legs, leave the eggs and spread out on the under-surface of the leaf to feed. In the fourth and later stages they are a grey-brown colour with conspicuous black triangular marks in a line along each side. The full-grown larva, almost two inches long and proportionately thick, enters the soil and forms a dark-brown pupa from which the moth emerges. The moth has a brown wing pattern, made up of light-brown areas, dark-brown spots and various white lines. The body is three-quarters of an inch long and the wingspan 1½ inches.

Control.

Since cluster caterpillar is rarely present alone, its control is generally achieved by measures taken against other pests. DDT, lead arsenate sprays or dusts, and poisoned dry bait are all effective in controlling this pest. The removal by hand of leaves harbouring clusters of young larvae during other operations will help to protect the remainder of the plant.

Leaf Miner.

The leaf miner* of tobacco, also known as the potato tuber moth, can be a serious pest in seed-beds and on young transplants. Young leaves may be completely destroyed and terminals badly injured, necessitating replanting. Older plants may have many of the lower leaves damaged, as well as some higher on the stalk. Injury results from the larvae tunnelling between the upper and lower surfaces of the leaf and leaving only the transparent double skin. This leaf mine often runs near one of the leaf ribs but can be quite extensive in breadth.

Plants in which leaf miner breeds are potato, tobacco, tomato, eggfruit, gooseberry weeds, nightshade ("blackberry"), wild tobaccos and thornapples.

Life History and Habits.

The egg is very small and is usually laid on the soil, although sometimes on the leaf surface. In four or five days the larva emerges and makes its way to a suitable part of the leaf. It feeds inside the leaf only, and in less than three weeks in summer passes through four growth stages, the final stage being responsible for most of the mining area. This final stage larva varies in colour from pink to grey-green and is about half an inch long. On completion of feeding, the larva either forms a silken cocoon to one side of a leaf mine and there transforms to a pupa, or leaves the mine and forms the cocoon in the surface soil near the leaf. About a week later the moth emerges. The period from egg to adult varies from three to four weeks in summer. The moth is a rapid flier. It is three-eighths of an inch long, and when at rest the dark-brown speckled wings are folded along the back.

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* *Gnorimoschema operculella* (Zell.).

Plate 50.

Tobacco Leaves Damaged by Leaf Miner.

Control.

DDT sprays or dusts used at weekly intervals in the seed-bed and during the first three weeks of the life of the crop in the field will protect tobacco plants from the more serious form of leaf miner attack. Treatment should not be delayed until leaf mines are seen, because the presence of nearby potato crops, late winter and spring weeds, or volunteer tobacco plants is sufficient in most instances to provide moths to damage the tobacco crop.

Lead arsenate treatment may afford some protection but is seldom an effective control.

Stem Borer.

Closely allied to the leaf miner, the stem borer* is almost indistinguishable from it in the young stages. Its damage, however, mainly takes the form of tunnelling in stems and large midribs, although some leaf mining may occur near tunnelled ribs. In seedlings and young plants the stem tunnelling may cause wilting and destruction of the terminals, while in older plants only individual leaves are affected. As well as wilting, a swollen upper stem is often indicative of the presence of stem borer in seedlings at planting time.

Other host plants of stem borer in Queensland are two species of *Nicotiana* (wild tobaccos).

* *Gnorimoschema heliopa* (Low.).

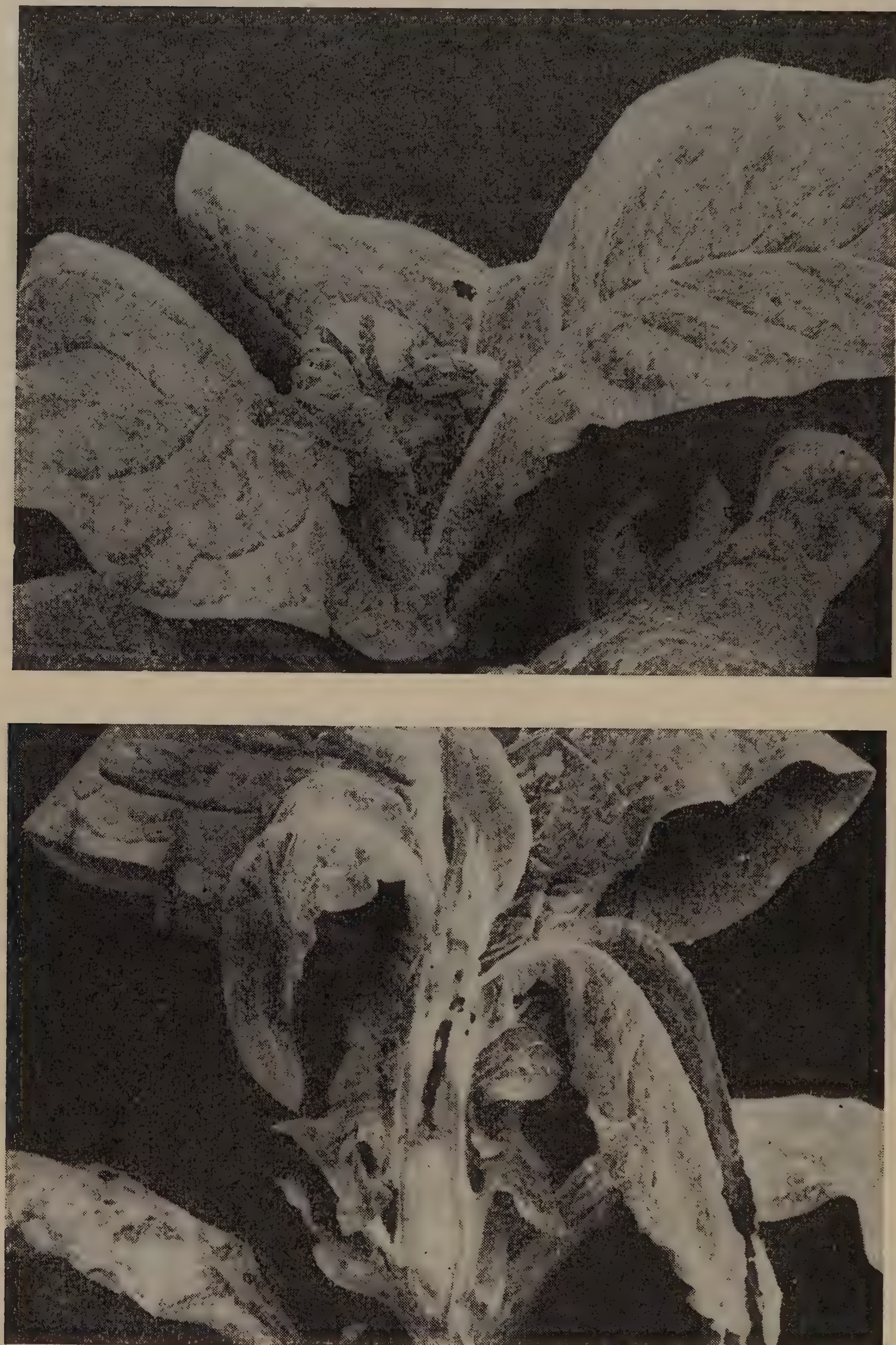

Plate 51.

Stem Borer Damage to Tobacco Plants. Top, external view. Bottom, internal view.

Life History and Habits.

The egg, which is slightly smaller than that of the leaf miner, is laid on the plant and hatches in four or five days. The larva is very similar to that of the leaf miner, but it takes about five to six weeks to pass through five larval stages. The pupa is formed inside the stem or midrib where the larva has been feeding, and after a further week

the adult pushes its way to the outside through a prepared exit. The moth is much the same in size as the leaf miner moth, but has brown wings.

Control.

The DDT protective treatment recommended for leaf miner will also protect plants from stem borer attack. Where an attack has begun in young transplants, replanting can often be avoided by breaking off the stem below the affected terminal and allowing one basal sucker to grow. This should be followed by a DDT schedule if the attack is sufficiently extensive to warrant it.

Cutworms.

A number of species of caterpillars known as cutworms shelter in soil during the day and emerge at night to feed. They usually attack the succulent stems or leaves of annual weeds or young crop plants, often cutting off the plant near or slightly above ground level. One cutworm may destroy several plants in a row during one night. In tobacco, the bulk of the damage is done during the fortnight following transplanting.

One of the commonest species in Queensland is the brown cutworm*, which attacks tobacco, cotton, maize and various vegetables in addition to succulent weeds such as pigweeds and bullhead.

A preference is shown for the light-textured, well drained parts of a field and attacks may be expected on "sandy ridges." Adjacent areas of weeds provide breeding grounds from which cutworms migrate to freshly planted seedlings. It has been recorded that major outbreaks of cutworms usually occur during a dry period following a series of dry years.

Life History and Habits.

The eggs are laid in batches in the soil beneath a suitable host plant. After three days or longer the very small larvae emerge and move up to the leaves of a suitable plant to feed. Later stages feed only at night and their strong build enables them to attack soft stem tissue. There are six larval stages, the later ones damaging tobacco. They are grey-brown or grey-green soft grubs up to 1½ inches in length which curl up when disturbed. After four weeks the larva pupates in the top few inches of surface soil, and from the brown pupa the moth pushes its way out to the surface some two weeks later.

The cutworm moth has slightly longer wings than the other tobacco moths. The forewing is narrow, is brownish in colour and has a pattern which includes three characteristic rounded areas.

Control.

Control is discussed under the heading "Control of Cutworms and Wireworms" on page 99.

Wireworms.

Wireworms† are hard, shiny, thin worms which inhabit soil; some species feed on plant roots and stems. When tobacco is planted out, the wireworms surviving the destruction of the original host plants and later cultivation attack the roots or tunnel inside the stems. Wireworm attack during the week following transplanting of tobacco usually results in the death of the plants.

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* *Euxoa radians* (Gn.).

† Elateridae.

Life History and Habits.

Since a number of species are involved and none of them are primarily concerned with tobacco, it will suffice to say that the egg, larval and pupal stages of wireworms are passed in the soil and often occupy a period of a year or more. The larva, which is usually less than two inches in length, is yellow or brown and may have a rounded or slightly flattened body. The adults are known as "click" beetles from their habit of making a clicking noise by bending the body when in distress.

Control.

This is discussed in the section on "Control of Cutworms and Wireworms" on page 99.

Plate 52.

An Irregular Stand of Tobacco Caused by False Wireworm Attack.

False Wireworms.

Two species of false wireworms* damage tobacco, one mainly in southern Queensland, the other in the northern districts. Both the larva and the adult beetle attack tobacco transplants by nibbling the stem at or near ground level. Established plants are more resistant, so the critical period is again the first week after transplanting. Tobacco on older cultivated land that has been under weed fallow is more subject to attack than that on new country.

Life History and Habits.

The immature stages are passed in the soil, but the beetle spends some of its life above ground and on a sunny day large numbers can be seen moving about the soil surface at the edge of a fallow field. In

* *Dasus macleayi* Blk. and *Dasus carpentariae* Blk.

appearance the false wireworm larva is like a true wireworm except that the rear segment is always rounded. It is usually less than an inch in length when full-grown, and can be found in the soil close to the stem of the plant. The beetle is oval in shape, grey-black in colour, and nearly three-eighths of an inch in length. Both species conform to this general description of larva and adult.

Control.

This is discussed in the next section.

Control of Cutworms and Wireworms.

As cutworms, wireworms and false wireworms are soil inhabiting pests attacking the stems or roots of tobacco mainly during the immediate post-transplanting period, methods for their control are discussed under a single heading.

Continuous clean cultivation and clean headlands during soil preparation will reduce the population of cutworms. Further help in the control of these pests is obtained by using properly hardened seedlings, since these can withstand light attacks on the stem better than the more succulent ones.

Baiting is a method of controlling cutworms and false wireworms which has been successfully used in tobacco fields. The bait is prepared by mixing thoroughly 25 lb. of bran and 1 lb. of Paris green (or 2 lb. arsenate of lead or 2 lb. 4% BHC, 0·5 per cent. gamma isomer) while still dry. One quart of molasses is then dissolved in a pint of boiling water, and this solution is made up to two gallons by the addition of cold water. The diluted solution is added to the dry bran-insecticide. The final consistency should be crumbly and not over-moist, thus permitting the material to trickle through the fingers.

If a field is known to be infested prior to planting, the bait should be broadcast at the rate of 50-100 lb. bran per acre, during the late afternoon, a day or two before the planting out, concentrating on the ridges of the field. If infestation is not noticed until after planting the bait should be strewn along the rows, when less material will be needed.

As an alternative to the older baiting methods, the use of BHC (benzene hexachloride) dust in the soil protects transplants from cutworms, wireworms and false wireworms. When correctly placed the degree of protection is high, but misuse of this dust may result in plant injury, and, in addition, later root crops such as potatoes may acquire a BHC taint. The aim is to have the plants centred in a 6-inch wide strip of soil treated with not more than 36 lb. of 10 per cent. BHC, 1·3 per cent. gamma isomer, per acre (that is, 3½ oz. of dust per chain of row with 4-feet interspace). The dust should be lightly mixed with the top 1-1½ inches of soil.

Root Knot Nematode.

One of the most widespread soil inhabiting pests of tobacco in Queensland is root knot nematode*. As a result of its activities the roots become swollen or galled, conducting tissues carrying plant food and water to the leaves are partly destroyed and in wet soil the galled roots quickly rot. Infested seedlings remain stunted and may die. Older plants yield papery leaf and under hot, dry conditions wilt readily. Tobacco is only one of a long host list for this pest.

* *Heterodera marioni* (Cornu) Goodey.

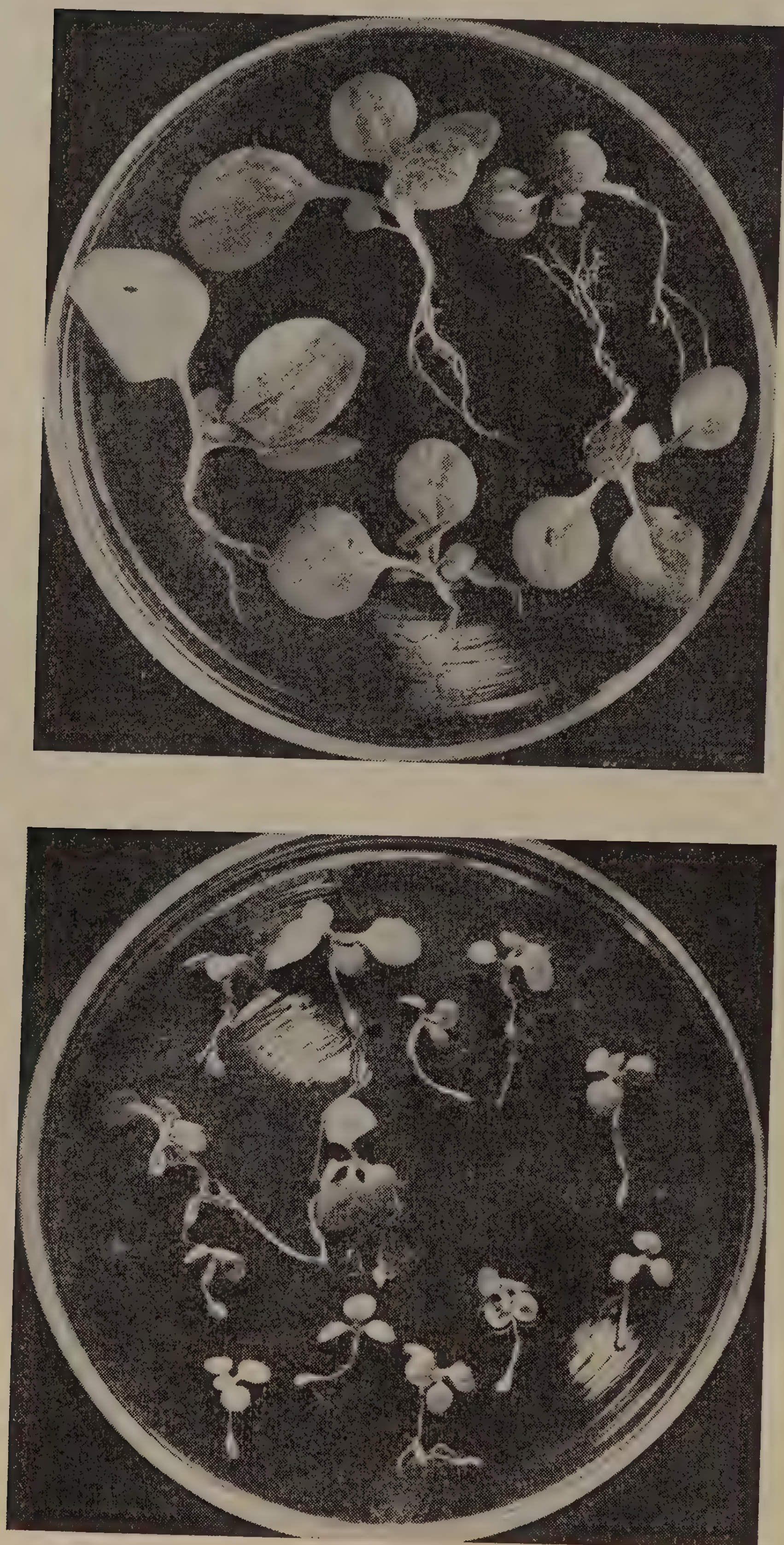

Plate 53.

Normally Healthy Tobacco Seedlings (top) and Seedlings Infested by Nematodes (bottom).

Life History and Habits.

All stages of the root knot nematode are minute forms; the adult female is visible to the naked eye as a glistening pearly-white globule protruding slightly from the cut surface of a gall. About 50 eggs may be produced by one female. The young larvae, which move freely in the soil, are called eelworms.

Plate 54.
Tobacco Roots Heavily Infested with Nematodes.

Field Control.

Measures which are often suggested for the control of this pest embrace such methods of land management as crop rotations, long fallows, clean fallows and the growing of certain cover crops. Experience has shown that the behaviour of this nematode is erratic, and for practical farming purposes its regular control is beyond specific cultural means. Vigorous plants, however, withstand nematode infestation better than those subjected to poor growing conditions. To this extent, therefore, good farming practices are a help in combating the pest.

Soil fumigation with DD (a material quite distinct from DDT) to keep tobacco free from nematodes during early growth has been practised in Queensland, but the treatment is not yet standardised. One method consists of a double row of injections each one foot apart and one foot between the rows along the planting lines three weeks before planting out. A dosage of 2 c.c. per injection to a depth of six inches should be used and injection holes must be well sealed. By increasing the quantity of this expensive material to 20 gallons per acre complete treatment of the field at one foot intervals may be attained, but the additional economic advantages of such a method of application are doubtful. It is important that the soil at the time of fumigation should be in fine tilth, be moderately moist, and not contain unrotted crop residues. Reducing the stipulated time of three weeks between fumigation and planting may result in crop injury.

For treating small fields with DD, a hand injector has been manufactured, and for large areas attempts have been made to use machinery. As with all soil fumigation, the basic factor in success is that the work is done thoroughly.

MINOR FIELD PESTS.

Grasshoppers and locusts, thrips, the green vegetable bug, the brown vegetable weevil, a mite and small leafhoppers have made spasmodic attacks on tobacco in Queensland. The mite, the brown vegetable weevil, and thrips are localised in the south-western districts.

SEED-BED PESTS.

Ants.

Various ant species may carry surface sown tobacco seed to their granaries. Lightly covering the surface of the beds with river sand after planting helps considerably in checking the activities of these pests.

Other ant species remove the leaves of the seedlings soon after germination. As these pests prefer maize meal, broadcasting of this material on the beds at the rate of 12 oz. to 100 sq. ft. will yield satisfactory results.

Care should be taken to destroy colonies of mound ants with carbon bisulphide or chlordane before preparing the site as a seed-bed.

Root Knot Nematode.

When the root knot nematode is active on very young seedlings, injury appears as patches of yellowed, stunted plants. With later attacks the yellowing may not be so pronounced, but these plants are the first to wilt when water is withheld for hardening. Seedlings with root galling should not be planted in the field, as the resultant crop is almost certain to be poor, and at the same time clean ground may be contaminated. To ensure that sufficient clean seedlings are obtained from the sandy soils in which they are generally sown, some form of soil sterilization is necessary.

As well as eradicating nematodes, seed-bed sterilization should help in the control of weeds, and at the same time must not interfere unduly with the subsequent growth of the seedlings. Three methods, depending on the ready availability of suitable materials and equipment, have been used successfully in Queensland.

1. *Firing.*—A 4-inch layer of broken woody honeycomb material from the interior of the mound of a termite* is spread over the moist area to be used for beds and paths. This is ignited on the windward edge and is left to burn across the area. When cool, the coarse material is raked off the beds and the fine ash is worked into the soil. When antbed material is not available, light brushwood piled several feet high may be substituted. Fertilizing and planting should be carried out as soon as possible after firing. When materials are available, this method is ideal for seed-bed sterilization.

2. *Steaming.*—The soil should be dry and steam is applied until the temperature is 150° F. at a depth of nine inches. Pan steaming, utilising sheet iron covers designed for blue mould treatment, has been used with some success. Boiler equipment, which is necessary to give the high steam pressures required for thorough work, is expensive.

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* *Coptotermes acinaciformis* (Frogg.).

3. *Fumigation.*—If firing or steaming is not possible, only DD fumigation can be recommended as an alternative. A special effort should be made to eliminate weed seeds from the intended seed-bed area by early watering and soil preparation. Three weeks prior to planting the whole area should be treated when in good tilth to a depth of six inches with injections one foot apart, the holes being well sealed. Dosage rate should be 25-30 gal. per acre (that is, $2\frac{1}{2}$-3 c.c. per injection). The soil may be stirred once or twice about a week before forming the beds. Thorough DD treatment alone will control nematodes in seed-beds, but it does not eliminate weed growth.

Other chemicals or chemical combinations used in tobacco beds in Queensland include cyanamid-urea mixtures, cyanamid-DD, and chloropicrin. All these have some unsatisfactory features.

Other Pests.

Nearly all the field pests of tobacco may appear in seed-beds, which can be protected by weekly sprayings with DDT. This is desirable as a standard practice, particularly to prevent leaf miner and stem borer becoming established. Wireworms are seldom of importance as seed-bed pests. The rare instances of heavy grasshopper or locust attacks may necessitate the covering of beds with open mesh cloth or netting.

GENERAL CONTROL SCHEDULE.

Seed-beds.

Prepare seed-bed sites early and eliminate as many weeds as possible.

Sterilize the beds and paths before planting.

Spread a layer of medium grade river sand to a depth of one-eighth of an inch on the beds after planting, as protection against seed harvesting ants.

Two weeks after germination, or earlier if necessary, commence light weekly spraying with 0·1 per cent. DDT. The spray should be directed horizontally from each side of the bed, and should be applied after the last watering for the day.

Give the seedlings a thorough spraying with DDT-lead arsenate before transfer to the field.

In the Field.

During the first three weeks in the field, weekly routine sprays with DDT-lead arsenate* should be made. If a dust is preferred, equal weights of intimately mixed 5 per cent. DDT and lead arsenate should be used. The dry bait for budworm is prepared by mixing thoroughly 1 lb. of lead arsenate with 20 lb. of bran, pollard or maize meal.

The successful and economical control of all field pests after the first three weeks depends on constant observation, particularly the recognition of young stages.

A PEST OF CURED LEAF.

The tobacco beetle† is the most widely distributed and serious pest of cured leaf in farm bulk sheds. It may appear in a new bulk shed from a number of sources, such as breakfast meals and mosquito coils, particularly where living quarters are built on to the bulk shed.

* This insecticide mixture (0·1 per cent. DDT and 3 lb./50 gal. lead arsenate) is specifically mentioned as the newer materials have not been used commercially on an extensive scale.

† *Lasioderma serricorne* (F.).

Leaf left in bulks or bales is attacked by beetles and larvae and is eventually riddled and reduced to powder, particularly near the outside of the bulk.

Life History.

The beetle lays eggs singly on the cured tobacco leaf. The egg hatches in about a week, and the white, curved, hairy larva begins feeding immediately. Four to 10 weeks later, the larva forms a webbed covering or finds a small space and changes to a pupa. This stage occupies a week or more. The adult is oval in outline, brown in colour, and about one-tenth of an inch in length.

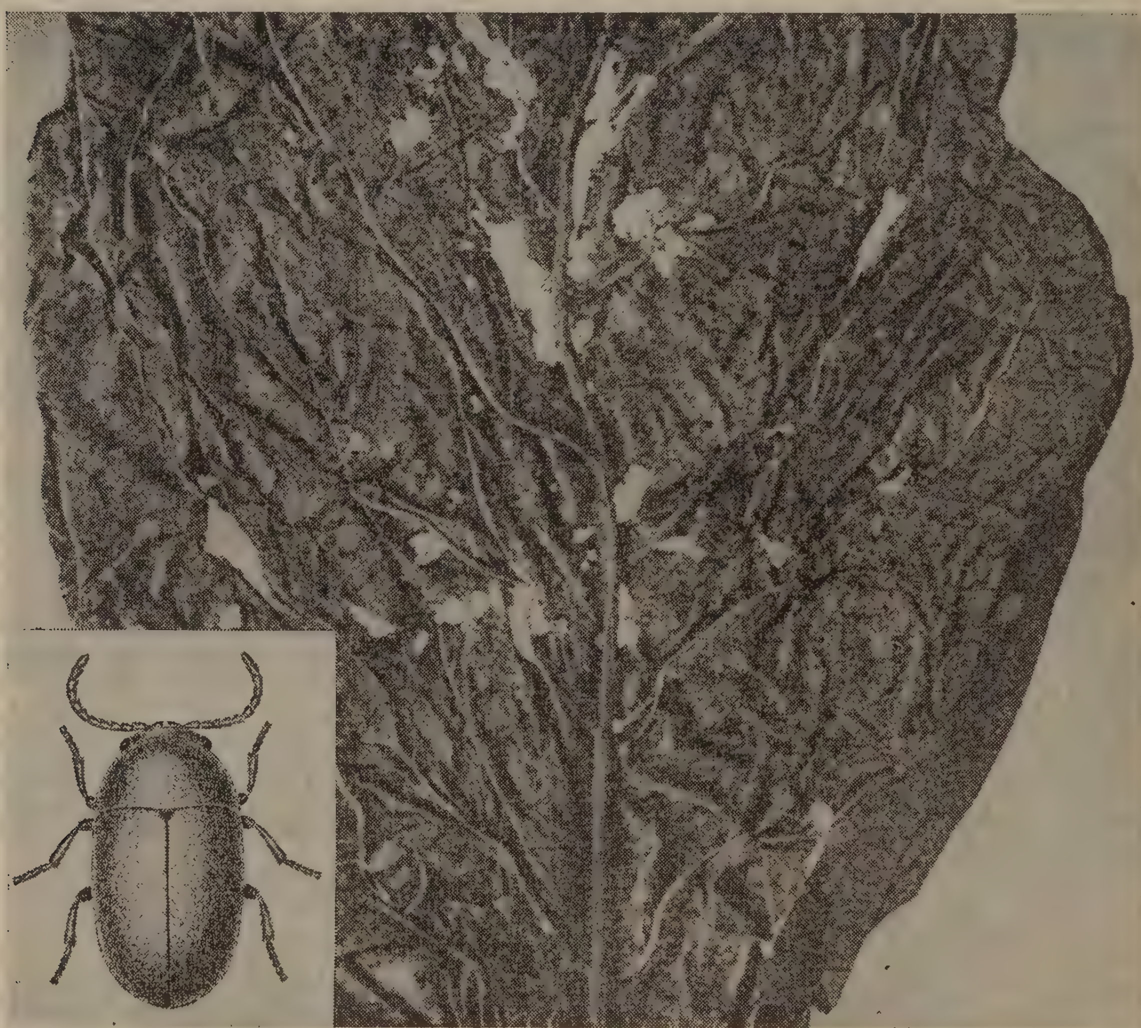

Plate 55.

Damage to a Stored Leaf by the Tobacco Beetle. An adult tobacco beetle is inset.

Control.

Between seasons the bulk shed on the farm should be cleaned thoroughly to remove tobacco debris from both inside and around it. Insecticides used in the empty bulk shed, such as DDT as a dust, spray or swab, or BHC as an ''odourless'' smoke, help to destroy carry-over beetles. If a dust is used, the surplus should be swept up, and after all treatments the shed should be aired thoroughly. These methods are less hazardous than fumigation.

If leaf is held over from season to season, it should be frequently inspected for tobacco beetle. Infested bulks can only be freed from the various stages of the pest by breaking down for treatment. The most effective method on the farm is to restring the leaf on sticks and expose it in the barn for two hours to temperatures of 140-150° F.

The Grape Scale.

A. W. S. MAY, Entomologist, Science Branch.

THE grape scale* has been recorded from many deciduous fruit producing areas of the world and is well established in most States of Australia. Though regarded chiefly as a pest of grapes, it also attacks a wide range of cultivated plants, including plum, peach, apricot, pear, mulberry and several ornamental trees and shrubs.

During recent years, this insect assumed pest proportions in vineyards and orchards in the Stanthorpe area. Grapes were more usually affected, though certain varieties of plums and pears were often heavily attacked. Populations were high during the 1950-51 season, but the hot, dry weather of the following spring and early summer, together with the activity of natural enemies, took a heavy toll of scales and the outbreak waned rapidly as the season progressed.

SEASONAL HISTORY.

This scale (Plate 56) passes the winter months in various stages of growth but mainly as partly developed females. These may be located on the canes or under the bark on the older wood. Most of the overwintering scales become fully grown in the late spring, when egg-laying takes place; 2,500 eggs may be found under one scale. On hatching, the young scales crawl from beneath the parent and settle down to feed on the new growth. The remains of the parent scale may persist on the vines for some time but falls off eventually, leaving a whitish oval mark to denote its place of attachment.

When partly grown, most of the scales migrate either to the undersurface of the canes or beneath bark on the older wood. Here they settle down to continue their development, which is slow since there is only one generation each year. If the infestation is severe, canes may be encrusted completely.

DAMAGE.

The pests feed by sucking sap, resulting in a general loss of plant vigour. Such injury is intensified in the spring as the females approach maturity. This, however, is of secondary importance to the development of the sooty mould fungus that thrives on the secretions from the scales. Leaves, branches and fruit become coated with a black deposit which may render the fruit unfit for market.

Infestations are rarely uniformly distributed throughout vineyards and only individual vines or groups of vines may provide conditions suitable for heavy scale development. If populations are high, a few vines may be killed. Varietal preferences are shown, Muscatels and, to a lesser extent, Waltham Cross being more susceptible.

In plums and pears, infestations are more evenly distributed throughout a block; the variety Santa Rosa has proved the most susceptible of the plums.

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* *Eulecanium persicae* (Geoff.).

CONTROL MEASURES.

Outbreaks similar to the one recently experienced have occurred in vineyards in the Stanthorpe area following periods of negligible scale activity. Though natural enemies are of great importance in eventually destroying such outbreaks, chemical control measures are necessary to prevent populations developing to levels where fruit losses are experienced.

During years when this scale is inactive, chemical control measures may be unwarranted, but the potential importance of this pest should not be disregarded. Each season its status can be determined by inspection and control measures applied if required.

Plate 56.

Grape Spurs Infested With Mature Female Scales.

Dormant Spraying.

The application of a *dormant oil spray* (1-20) during July or early August will prove most effective against this scale, but complete coverage is essential for maximum benefit.

Many growers prefer to delay spraying until after pruning. As this latter operation is usually left until the sap commences to rise so as to retard vine development and reduce the likelihood of frost injury, the application of *dormant oil* at this time may cause injury to the vines and check early spring growth. The substitution of a *semi-dormant* oil after mid-August, either alone or in combination with lime sulphur, would reduce the likelihood of injury to the vines, provided the spray is not applied later than mid-September.

Summer Spraying.

Many difficulties are encountered if the control of this pest is delayed until summer. The obtaining of complete spray coverage will be made harder by the leafiness of vines, and the prolonged hatching of the scales prevents effective timing of spray applications. Sulphur treatment for powdery mildew control prohibits the use of a *summer oil*, as spray incompatibility will cause crop injury.

If scale populations are high and control measures are desirable, *white oil* (1-40) may be applied at the partial expense of powdery mildew control. Sulphur cannot be used safely for at least three weeks before or after white oil application.

Alternative insecticides for summer use cannot be recommended at present.

Where a dormant or semi-dormant oil has been applied, the hazards associated with summer control measures will not arise.

Vegetable Crops and Soil Reaction.

Most of the vegetables grown in Queensland are produced on soils which are naturally acid. Generally speaking, these soils are also well drained, and high rainfall or irrigation combined with frequent applications of sulphate of ammonia tends to make them even more acid.

Soil reaction—that is, the degree of its acidity or alkalinity—is measured and expressed as pH. The pH scale runs from 0 to 14. The neutral point is 7; soils with a lower pH are acid and those with a high pH are alkaline. It is usual to class values of 4·0 to 5·5 as strongly acid, 5·5 to 6·5 as acid, 6·5 to 7·5 as neutral, 7·5 to 8·5 as alkaline, and over 8·5 as strongly alkaline. The pH of soils generally lies between 4·0 and 10·0, but most of the horticultural soils of Queensland are strongly acid to neutral (pH 4·5 to 7).

All plants do not thrive at the one pH value; each variety has a range within which it grows best. Some crops are very sensitive to acidity, some to alkalinity, and some can tolerate a wide range of soil pH. The following may be taken as representing the best pH values for various vegetable crops:—

pH 6.0 to 7.5
Bean
Beetroot
Cabbage
Pea
Spinach

pH 6.0 to 7.0.
Broccoli
Celery
Lettuce
Radish

pH 5.5 to 7.5
Cauliflower
Pumpkin
Tomato

pH 5.5 to 7.0
Carrot
Cucumber
Parsnip
Rhubarb
Squash
Turnip

Excessive soil acidity may be reduced by the application of limes of various types, but the amount required depends not only on the original pH of the soil but also on the texture of the soil, sandy soils requiring less than clays.

TUBERCULOSIS-FREE CATTLE HERDS.

(AS AT 7th JULY, 1952.)

Breed.	Owner's Name and Address of Stud.
Aberdeen Angus	The Scottish Australian Company Ltd., Texas Station, Texas
	F. H. Hutton, " Bingegang," Dingo
A.I.S.	F. B. Sullivan, " Fermanagh," Pittsworth
	D. Sullivan, " Bantry " Stud, Rossvale, *via* Pittsworth
	W. Henschell, " Yarranvale," Yarranlea
	Con. O'Sullivan, " Navillus Stud," Greenmount
	H. V. Littleton, " Wongalea Stud," Hillview, Crow's Nest
	J. Phillips and Sons, " Sunny View," Benair, via Kingaroy
	Sullivan Bros. " Valera " Stud, Pittsworth
	Reushle Bros., " Reubydale " Stud, Ravensbourne
	H. F. Marquardt, " Chelmsford " Stud, Wondai
	W. G. Marquardt, " Springlands," Wondai
	A. C. and C. R. Marquardt, " Cedar Valley," Wondai
	A. H. Sokoll, " Chelmsford," Wondai
	W. and A. G. Scott, " Welena," A.I.S. Stud, Blackbutt
	G. Sperling, "Kooravale" Stud, Kooralgin, via Cooyar
Ayrshire	L. Holmes, " Benbecula," Yarranlea
	J. N. Scott, " Auchen Eden," Camp Mountain
	"St. Christopher's and Iona" Studs, Brookfield Road, Brisbane
	E. Mathie and Son, "Ainslie" Ayrshire Stud, Maleny
Friesian	C. H. Naumann, " Yarrabine Stud," Yarraman
	J. F. Dudley, " Pasadena," Maleny
Guernsey	C. D. Holmes, " Springview," Yarraman
Jersey	W. E. O. Meier, " Kingsford Stud," Rosevale, *via* Rosewood
	J. S. McCarthy, " Glen Erin Jersey Stud," Greenmount
	J. F. Lau, " Rosallen Jersey Stud," Goombungee
	G. Harley, Hopewell, Childers
	Toowoomba Mental Hospital, Willowburn
	Farm Home for Boys, Westbrook
	F. J. Cox and Sons, " Rosel " Stud, Crawford, Kingaroy Line
	R. J. Browne, Hill 60, Yangan
	P. J. L. Bygrave, " The Craigan Farm," Aspley
	A. Verrall and Sons, " Coleburn Stud," Walloon
	R. J. Crawford, " Inverlaw Jersey Stud," Inverlaw, Kingaroy
	P. H. F. Gregory, " Carlton," Rosevale, *via* Rosewood
	E. A. Matthews, " Yarradale," Yarraman
	A. L. Semgreen, " Tecoma," Coolabunia
	G. & V. Beattie, " Beauvern," Antigua, Maryborough
	L. E. Meier, " Ardath " Stud, Boonah
	A. M. and L. J. Noone, "Winbirra," Stud, Mt. Esk Pocket, Esk
	W. S. Conochie and Sons, "Brookland" Stud, Sherwood Road, Sherwood

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The Problem of Brand Damage in Wool.

R. E. CHAPMAN, Wool Technologist, Sheep and Wool Branch.

THE presence of brands in wool, not readily removable by scouring, is a problem of major importance to the wool processing industry and probably causes more inconvenience and irritation than any other single factor encountered by the manufacturer. Considerable time and labour is expended each year in sorting and clipping brands from raw fleeces, as well as in "depitching" noils and removing brand spots from processed material. This is becoming more expensive as labour costs continue to increase. Enquiries amongst manufacturers in Queensland reveal that they buy only wool which is free from brand marks.

The so-called "tar" stains that are left after scouring result mainly from the use of branding fluids based on drying oils which form a hard residue on exposure to the air. In the case of black fluids this solid residue on the fleece resembles tar, although tar itself is rarely used nowadays for branding sheep.

Due to the great inconvenience caused by brand marks, careful sorting is necessary before any manufacturing processes are undertaken. During the branding of sheep small drops are often accidentally splashed on parts of the fleece and these may be missed by the sorters in spite of great care. Hence they remain undetected until later in the process of manufacture, and are as troublesome as the brands themselves. Even if it were possible to have perfect sorting, there still remains the problem of the wool containing the brands, as this requires the special expensive treatment of "depitching," which has been estimated to add up to eightpence to the cost of processing each pound of wool.

MILL PROCESSING DIFFICULTIES.

In spite of the great care it is humanly impossible for the sorter to detect and remove all the wool with brand marks. Consequently some are carried along with the wool during processing. The following gives an outline of what happens to a non-scourable brand.

Scouring:—During ordinary commercial scouring the hot solutions tend to soften the brand residues and the pressure of the rollers spreads any of the softened branding material which remains in the fleece. The expensive lappings of the rollers themselves may be contaminated

Plate 57.

A Sample of 58's–60's Greasy Merino Wool Contaminated with Non-scourable Brand Marks. Here the tips of the staples are firmly matted together with the dried brand residues.

Plate 58.

Showing Brand Marks which Remained in a Sample of 58's–60's Merino Wool after Scouring. Note how the hard residues have been practically unaffected by the scouring. These remain in the wool and are further distributed during the process of manufacture.

by the brand material and so pass it on to otherwise clean wool. Hence there is a snowballing effect: a small brand spot which enters the scour may be widely distributed during this early stage of manufacture. When the scoured wool is dried the brand marks form hard lumps which make it difficult subsequently to separate the fibres.

Plates 57 and 58 show samples of a 58's-60's Merino wool contaminated with brand marks in the greasy and scoured states respectively. The hard residues on the tips of the staples have been practically unaffected and thus remain in the wool to cause further trouble later in the manufacture.

Carbonising:—Carbonising is that part of manufacturing in which the vegetable matter that remains in the wool after scouring is removed. Some of the small brand fragments may be sufficiently friable to be separated with the vegetable dust, but the greater proportion is retained in the wool.

Carding:—In the carding operation the wool staples are separated into individual fibres and thoroughly mixed. Thus the brand particles on the staples are broken into a large number of tiny fragments and distributed still further throughout the wool. The teeth on the rollers of the carding equipment are liable to be bent by the hard brand residues, which also tend to prevent the separation of the wool fibres. This causes additional wear on the card teeth as well as considerable breakage of fibres.

Combing:—If the wool is to be used in the worsted trade it next passes through the process of combing. The object of this is to straighten the fibres in the carded wool, lay them parallel to one another and separate the short from the long fibres. The short fibres form what is known as "noil," which is collected in bins beneath the combing machine, whereas the long fibres leave as a continuous sliver about one inch in diameter. This is rolled into balls of a certain size known as "tops," and it is from these that worsted cloths are made. Nearly all branded wool is concentrated in the "noil," leaving the "tops" almost free of defects. Consequently the problem of brands is of little importance in the worsted trade.

In the woollen trade (blankets and flannels) and felt manufacture, the trouble due to non-scourable brands is accentuated because noils form a fair proportion of the raw material used, and the amount of brand residues in this is greater than in the scoured wool. Any fleece wool used in the woollen industry has to be carefully sorted, since there is no combing process which will remove the brands as in the worsted trade. A small pin-point of brand may well pass unnoticed until the heat and pressure of piece-scouring or milling cause it to spread and stain the cloth. This is particularly serious in the felt industry, as the wool is subject to considerable heat and pressure during the manufacture. Plate 59 shows a felt hat form ruined by brand marks, one of which is shown enlarged in the inset.

The seriousness of this problem has become more acute in recent years owing to the preference for light pastel shades, especially for ladies' apparel. Any brand mark in these cloths stands out in sharp contrast, and as it is usually impossible to remove the stains completely by "spotting" with a solvent, these cloths have to be re-dyed to a darker colour.

Plate 59.

Showing a Felt Hat Form Ruined by Brand Marks. An enlargement of one of these marks is shown in the inset, from which it can be seen how the particles of brand residues have spread during the manufacture.

Summary.—Careful sorting, in which labour costs are high, removes as much of the wool carrying brand residues as is humanly possible, but some escapes detection. These marks are not removed by scouring and tend to spread due to the heat and pressure used in this process. The expensive lappings on the scour roller may also be contaminated and so stain otherwise clean wool. In the carding operation, the pieces of brand are distributed still further and teeth on the faces of the card rollers may be bent by these hard particles, which are retained in the wool during the manufacturing process. In the finished article the brand marks show up as spots due to the spreading effect of the hot solutions used in piece-scouring, or milling. Hand "spotting" of these marks with solvent is very tedious and requires considerable manual labour; hence labour costs increase. Also, it is rarely possible to remove these marks completely from light-coloured fabrics and felts, which consequently have to be re-dyed to a darker shade.

DEVELOPMENT OF A SCOURABLE BRANDING FLUID.

The problem of developing a suitable branding fluid has been difficult because the fluid has to resist the action of various weather conditions for a year and it must also be capable of complete removal by the scouring fluid. It is probably because the problem is twofold and overlaps both the primary and secondary phases of the industry that little progress was made until recent years.

Further complications arise from the variations which occur throughout the world in the methods of wool scouring. The one most widely adopted is the alkaline scour, but other processes include the acid scour, used in Germany, and the solvent scour, employed in some places in the United States. Not only are these three methods entirely different, but there are also considerable variations in temperatures and solutions used by mills with the same type of scouring.

Added to this is the wide diversity of weather conditions that exist throughout the wool producing countries. For instance, Queensland is one of the few countries with a major aggregation of woolgrowing sheep in the tropical and sub-tropical regions between 15 degrees and 30 degrees south latitude. Here a brand has to be able to withstand the rigors imposed by the heat, a high intensity of light, abrasion by dust, and an intermittent rainfall which may come from scattered showers or sudden downpours. There is an instance in Central Queensland during recent years when 12 inches of rain were received in one night. Different conditions from these are encountered in Great Britain and the United States of America, both of which are north of the tropics and lie between 30 degrees and 60 degrees north latitude. Because of this diversity of weather conditions, several countries have evolved branding fluids of different compositions.

The first systematic approach to the problem of developing a scourable branding fluid was made by the British Wool Industries Research Association during the years 1925-30. Two fluids were recommended from this work, one for use in Great Britain and the other for the Dominions. The former was composed of wool fat, barytes, colour and white spirit, while the latter had additions of resin and carnauba wax, and the barytes was replaced by kieselguhr. Unfortunately, the fluid recommended for the Dominions did not stand up to the rigors of the climatic conditions encountered. In some cases it formed a non-scourable residue, and was rather irritant to the sheep's skin. Consequently it was not widely adopted.

Very little research appears to have taken place during the 1930's and it was not until 1942 that further intensive work was undertaken in both the United States of America and Australia. From laboratory tests during the years 1942-44 with formulations based on lanolin, the United States Department of Agriculture decided on a preparation consisting of lanolin (100 parts by weight), carbon tetrachloride (25 parts by volume) and pigment (3 parts by weight). A small field trial with this fluid was begun in 1944, with larger scale trials during 1947-49. The pigments used were carbon black, chromic oxide green, ferric oxide yellow, ferric oxide red and ultramarine blue. Branding fluids made to this formula were reported to have suitable durability under United States weather conditions except for the yellow pigment, which became discoloured, and the blue, which turned almost black. The brands were also satisfactorily removed during normal commercial scouring. This preparation has one disadvantage, however, in that it requires heating, especially in cold weather, before being applied to the sheep.

Australian Research.

Investigations in Australia have been directed to the development of sheep branding fluids which are removable by commercial alkaline scouring, rather than to fluids which can be removed by all three scouring processes mentioned previously.

The work began in the Central Wool Committee laboratories in Sydney during 1942 and was continued later by the Commonwealth Scientific and Industrial Research Organization. Lanolin was chosen as the basic constituent in the development of a scourable fluid, as this substance satisfied the conditions of adherence to the wool during growth and removal during scouring. This had been realised by workers in other countries, but Australian research workers selected a different vehicle by means of which the lanolin and pigment were applied to the wool. Earlier workers in both Great Britain and the United States used an organic solvent, such as white spirit or carbon tetrachloride, for this purpose. This evaporated after the brand was applied to the sheep, leaving the lanolin and pigment attached to the wool. However, most of these solvents are irritant to the sheep's skin and may produce conditions conducive to fly strike.

Consequently, Australian workers investigated the possibility of using aqueous emulsions of the lanolin and pigment with volatile emulsifying agents. The purpose of the emulsifying agent was to stabilise the suspension of lanolin and pigment in water until it was exposed as a brand on the wool. Due to the volatile component, the emulsifying agent then decomposed, leaving the lanolin in a state which would be relatively unaffected by rain. The substance chosen as the volatile emulsifying agent was ammonium stearate, which lost ammonia when exposed to the atmosphere.

In preliminary laboratory experiments various preparations under trial were placed on sheep skin samples and subjected to fine sprays of water at various temperatures, as well as to outdoor exposure. From these tests it was seen that the lanolin emulsions might well prove satisfactory, but that it was also necessary to improve the weathering resistance of the lanolin by the addition of resin. During these early stages quite a number of preparations were discarded for one reason or another, but they were nevertheless useful in showing what difficulties

had to be overcome. One reason for the rejection of many of the preparations was that they did not remain as stable emulsions on storage for some time, but tended to separate into layers which could not be re-mixed very readily. The amount of ammonia used in the preparation was found to affect the stability of the branding fluid: the greater the amount the more unstable was the emulsion.

A further development was the inclusion of a quantity of tallow in the preparation. This allowed the use of larger amounts of ammonia without upsetting the stability of the emulsion and also gave greater control over the consistency of the fluid. It was found that there were still some changes occurring during storage and also that a fungus tended to grow on the liquid. Further variations were made to overcome these difficulties and a small quantity of either toluene or oil of *Eucalyptus phellandra* was added to prevent the growth of the fungus.

By 1947 it became apparent that there were four preparations which had the necessary stability on storage and which might be suitable for practical testing under field conditions.

From early field trials it soon became apparent that the colour of the fluid had an influence on its performance. Pigments which withstood weathering included Monolite Fast Scarlet RNS, Monastral Blue B.S., carbon black and iron oxide, while ultramarine blue quickly became dull on exposure.

Large scale trials were undertaken with one preparation which from previous work showed most promise. This was found to perform satisfactorily in a number of different climatic conditions and to be removable by normal alkaline scouring. Some of these trials were carried out during 1948-49 in the Julia Creek area of north-western Queensland and around Dirranbandi in the south of the State. It was found that between 800 and 1,000 sheep could be branded with one gallon of this fluid.

Subsequently, in 1950, the C.S.I.R.O. released a formula for large scale manufacture. This was later improved by reducing the amount of ammonia, and the recommended preparation of this fluid is as follows:—

26 lb. lanolin, 10¼ lb. G. gum resin, 7 lb. stearic acid, 3¾ lb. tallow are melted at 230 deg. F. with stirring until a smooth fluid is obtained. This is then poured into a solution of 2½ lb. ammonia (specific gravity 0·88) in 17 gallons of cold water with slow mixing. Subsequently 3 lb. toluene or 1 lb. oil of *Eucalyptus phellandra* is added as a preservative. This forms the basis of the fluid to which the pigment can be added to produce the colour required. Monolite Scarlet R.N.S. (5 lb.) can be mixed into the basic preparation in a ball mill to give a brilliant red fluid. Alternative substances that can be used are Monastral Blue B. S. (5 lb.) or carbon black (5 lb.) to give either a blue or black fluid.

This fluid is manufactured by several firms in Australia and is sold under the name of L.B.E. (Lanolin Base Emulsion) branding fluid; its price compares favourably with that of ordinary fluids at present in use. It was reported in January of this year that the L.B.E. fluid had successfully passed further commercial scouring tests after remaining on fleeces for 12 months. Three batches of wool were included in the demonstration, two with L.B.E. brands and one with ordinary brands. The wool with the L.B.E. brands was virtually free of marks after scourng and the remaining traces were removed in subsequent processing, while the ordinary brand marks were scarcely removed.

The clean wool from the batches with L.B.E. brands was converted into unblemished fine pastel shade fabrics, which is rather an exacting test as any brand marks would be readily seen.

This recent success does not mean that research on this problem has come to an end. Other pigments which are available in greater quantities than those recommended are being tried. Field trials are still in progress in Queensland, as well as in other States, and further work is being undertaken to develop a branding fluid which is suitable for wet sheep and which will not smear if rain falls immediately after branding. Progress is necessarily slow because a year must elapse in each trial so that weather resistance and subsequent scourability of the preparations can be fully tested.

THE PRACTICE OF BRANDING.

Branding of sheep to denote ownership is now optional in Queensland, as in the rest of the Commonwealth. However, it is hardly necessary to brand for this purpose if boundary fences are kept in good order. Some properties have already stopped branding without suffering any inconvenience. Under the *Diseases in Stock Acts,* it is compulsory to brand sheep travelling in this State with a T. As the period of travel is relatively short, there is no necessity for a T brand to last 12 months.

When branding is necessary it is important to use an absolute minimum of fluid to make the brand and particularly to avoid splashing small drops on to the fleece. A piece of sheep skin pelt in the branding pot forms a suitable absorbent pad and helps to prevent excess fluid from being carried on the branding implement, provided the pad is not swamped with fluid.

It will also greatly help the wool sorter if red brands are used in areas producing black tipped or blue wools, and similarly a blue or black brand is best in red-wool country. The L.B.E. fluid is readily available in blue, black and red colours and has been fairly widely used in southern States.

While the above points will help to reduce the damage due to brand marks, not until such time as non-scourable branding fluids are no longer used will the Australian wool clip be free from this serious defect.

COMPOST FOR THE GARDEN.

The garden compost heap is a cheap means of converting garden and household vegetable refuse into valuable fertilizing material. Materials such as lawn clippings, spent crops and vegetable tops should be used in this way, but the coarse, woody stalks of strong-growing plants should be avoided.

Using general garden and household refuse, the heap should be made on a 6-ft. square base and of such size that the final height is about three feet. The chopped-up material should be spread in layers several inches deep, each layer being treated in the following way:—

Sprinkle over with ground limestone, fork in loosely and give a sprinkling of superphosphate and sulphate of ammonia. If not already moist, the material should be dampened before building up the layers. Ammonia will be given off slowly, and it is necessary to build up and treat the successive layers quickly, so that the loss will be kept at a minimum. The final layer is not treated, and may be covered with an inch of soil.

The heap should be kept damp, but the amount of water used should not cause draining from the heap.

In summer the material should be ready for use after two months, but in cold weather bacterial breakdown is much slower. The capping of the first heap can be used as a base for another heap.

Milch Goats.

G. I. ALEXANDER, Cattle Husbandry Branch.

(Continued from the July issue.)

CARE OF THE FEET.

If goats are reared on country where their feet are not worn down as fast as they grow, the feet must be trimmed regularly every four to six weeks. If the feet are not trimmed the horn becomes long and distorted and the goat may become lame.

CASTRATION.

If the male kids are not to be kept for stud purposes or for meat they should be killed at birth. If intended for meat, they should be castrated at 10 days to three weeks and killed at 3-6 months. At this stage, they are excellent eating, resembling lamb in flavour.

THE GOAT SHED.

The goat shed need not be elaborate. The minimum requirement is a shelter shed of 4 feet x 5 feet x 5 feet high with a yard 15 feet x 8 feet. In addition, the animal should be tethered outside this area to feed.

Inside the shelter shed should be a milking stand, which for ease of milking should be about 18 inches off the ground (Plates 60 and 61). The bench described below and shown in Plate 61 is quite useful and can be kept on one side of the goat shed. For compactness, it may be hinged to the wall with two legs which are in turn hinged to the bench. When the bench is not in use, the legs may be folded under the bench and the bench folded down against the wall. Alternatively, a permanent bench may be erected.

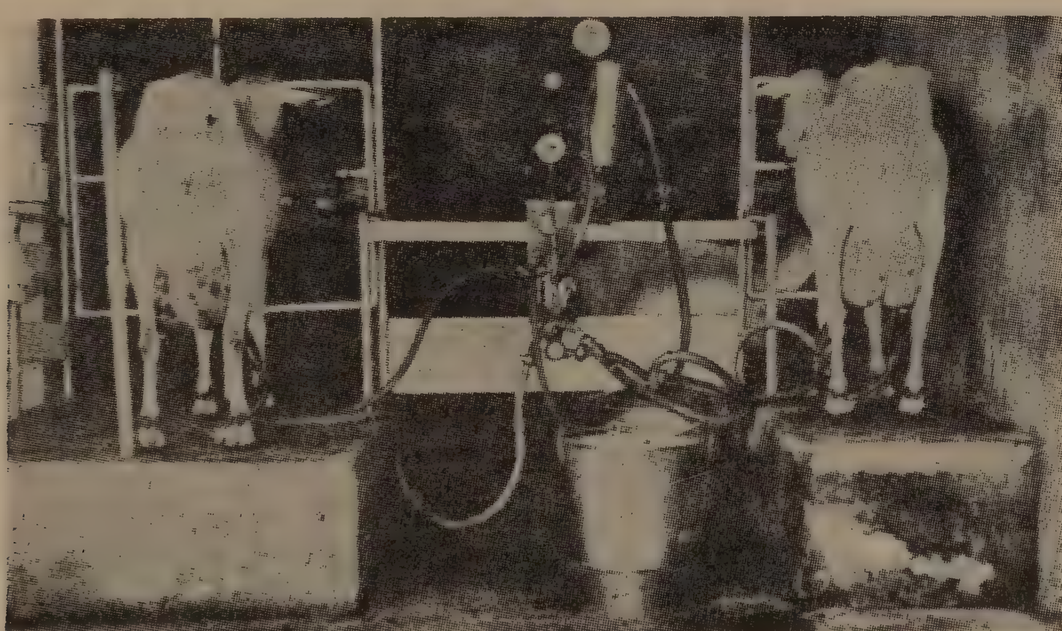


Plate 60.

Machine Milking of Goats on Milking Platforms.

While goats can be readily taught to stand while being milked, especially if being fed at the same time, some type of stall may be used to keep the animal under control. Two types are shown, one being a hinged type and the other resembling a keyhole. In the hinged type, the essential feature is that the hole be three inches wide, one foot long and 20 inches from the level of the bench. Both are useful when feeding, as they prevent the goat from scattering its food over the floor. The keyhole type is particularly useful when feeding hay from a rack, as it prevents the animal from pulling back from the hay and so scattering it on the floor. Goats are very particular about their food and will seldom eat hay which has been dropped on the floor.

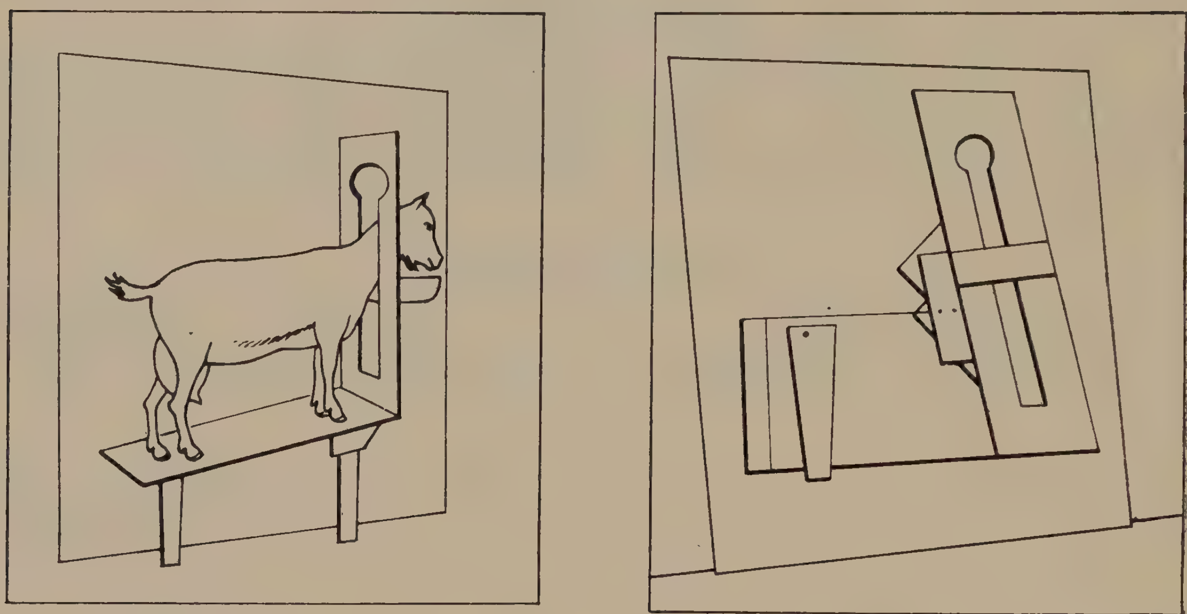


Plate 61.

Sketches of a Folding Milking Stand.

[*From "Australian Goat World."*

DISEASES OF GOATS.

Many diseases affect goats, causing unthriftiness, loss of milk production and sometimes death. Careful feeding and management will prevent or lessen the severity of many of these conditions. If the disease is one which is serious or which has not been experienced before, it is desirable to get the advice of a veterinary surgeon promptly, as delay or the use of home treatments may prove fatal.

The main diseases will be discussed in a later issue.

RENEW YOUR JOURNAL SUBSCRIPTION EARLY.

Journal subscribers are requested to renew their Journal subscriptions well in advance of the month of expiry, as it is often difficult to provide missing numbers.

Brucellosis Testing of Swine.

The Department of Agriculture and Stock is operating a scheme whereby pig herds are tested at intervals for the occurrence of swine brucellosis (contagious abortion).

A herd listed by the Department as "brucellosis tested" is one in which all such animals as may be determined by the Director of the Department's Division of Animal Industry have been subjected to two successive tests for brucellosis, at intervals determined by him, without any positive reactors being found.

In order for a herd to be retained on the list of Tested Herds, a semi-annual or annual re-test of the herd, as determined by the Director, is required. If at a re-test any animal gives a positive reaction to the test the herd is removed from the list; it is not listed again until subsequent tests, as determined by the Director, have been carried out.

Full particulars of the Brucellosis Testing of Swine and application forms may be obtained from the Under Secretary, Department of Agriculture and Stock, William Street, Brisbane.

TESTED HERDS.
(AS AT 7th JULY, 1952.)

Breed.	Owner's Name and Address of Stud.
Berkshire	S. S. Ashton, "Scotia" Stud, Pittsworth
	J. J. Bailey, "Lucydale" Stud, East Greenmount
	S. Cochrane, "Stanroy" Stud, Felton
	Garrawin Stud Farm Pty. Ltd., 657 Sandgate road, Clayfield
	G. Handley, "Handleigh" Stud, Murphy's Creek
	J. L. Handley, "Meadow Vale" Stud, Lockyer
	R. G. Koplick, "Melan Terez" Stud, Rochedale
	H. V. Littleton, "Wongalea" Stud, Crow's Nest
	O'Brien and Hickey, "Kildurham" Stud, Jandowae East
	E. Pukallus, "Plainby" Stud, Crow's Nest
	G. C. Traves, "Wynwood" Stud, Oakey
	E. Tumbridge, "Bidwell" Stud, Oakey
	Westbrook Farm Home for Boys, Westbrook
	H. W. Wyatte, Rocky Creek, Yarraman
	H.M. State Farm, "Palen Creek," Palen Creek
	A. R. Ludwig and Sons, "Cryna" Stud, Beaudesert
	H. H. Sellars, "Tabooba" Stud, Beaudesert
	F. Thomas, "Rosevale" Stud, Beaudesert
	Bowkett and Meacle, "Myola Vale" Stud Piggery, Burra Burri, Jandowae
	D. T. Law, Trouts Road, Aspley
	C. F. W. and B. A. Schellback, "Redvilla" Stud, Kingaroy
	R. H. Crawley, "Rockthorpe" Stud, via Pittsworth
	F. R. J. Cook, "Alstonvilla," Woolvi, via Gympie
	D. E. and E. C. Apelt, "Thelmur," Oakey
	Mrs. I. M. James, "Kenmore" Stud, Cambooya
	H. L. Stark, "Florida," Kalbar
	J. H. N. Stoodley, "Stoodville," Ormiston
Large White	H. J. Franke and Sons, "Delvue" Stud, Cawdor
	Garrawin Stud Farm Pty. Ltd., 657 Sandgate road, Clayfield
	F. L. Hayward, "Curyo," Jandowae
	J. A. Heading, "Highfields," Murgon
	K. B. Jones, "Cefn" Stud, Pilton
	R. G. Koplick, "Melan Terez" Stud, Rochedale
	R. Postle, "Yarralla" Stud, Pittsworth
	E. C. Smith, "Smithfield" Stud, Coomera
	E. J. Bell, "Dorne" Stud, Chinchilla
	A. G. Fry, "Birubi" Stud, Dalby
	N. E. Meyers, Halpine Plantation, Kallangur
	L. C. Lobegeiger, "Bremer Valley" Stud, Moorang, via Rosewood
	J. H. G. Blakeney, "Talgai" Stud, Clifton

TESTED HERDS—continued.

Breed.	Owners Name and Address of Stud.
Large White—*continued*	V. P. McGoldrick, " Fairymeadow " Stud, Cooroy
	N. Woltmann and Sons, Wooroolin
	R. S. Powell, Kybong, via Gympie
	E. B. Horne, "Kalringal," Wooroolin
	S. T. Fowler, "Kenstan" Stud, Pittsworth
	J. A. and J. McNicol, "Camden," Canning Vale, Warwick
	H. L. Larsen, "Oakway," Kingaroy
Tamworth	S. Kanowski, " Miecho " Stud, Pinelands
	N. R. Potter, " Actonvale " Stud, Wellcamp
	D. F. L. Skerman, " Waverley " Stud, Kaimkillenbun
	A. C. Fletcher, " Myola " Stud, Jimbour
	L. C. Lobegeiger, " Bremer Valley " Stud, Moorang, via Rosewood
	Salvation Army Home for Boys, Riverview
	F. Thomas, " Rosevale " Stud, Beaudesert
	A. J. Surman, Noble Road, Goodna
	P. V. McKewin, "Wattleglen" Stud, Goombungee
	Department of Agriculture and Stock, Regional Experiment Station, Kairi
	P. V. Campbell, Lawn Hill, Lamington
	E. C. Phillips, "Sunny View," M.S. 90, Kingaroy
	T. A. Stephen, "Withcott," Helidon
	W. F. Kajewski, "Glenroy" Stud, Glencoe
	A. A. Herbst, Bahr Scrub, via Beenleigh
	R. G. Koplick, Grieves Rd., Rochedale
Wessex Saddleback ..	W. S. Douglas, " Greylight " Stud, Goombungee
	D. Kay and P. Hunting, " Kazan " Stud, Goodna
	E. Sirrett, " Iona Vale " Stud, Kuraby
	C. R. Smith, " Belton Park " Stud, Nara
	H. H. Sellars, " Tabooba " Stud, Beaudesert
	H. Thomas, " Eurara " Stud, Beaudesert
	D. T. Law, Trouts Road, Aspley
	G. J. Wilson, " Glenbella " Stud, Silverleigh
	G. J. Cooper, "Cedar Glen", Yarraman
	J. B. Dunlop, Acacia Road, Kuraby
	A. Curd, Box 35, Jandowae

HAVE YOUR SEEDS TESTED FREE

The Department of Agriculture and Stock examines FREE OF CHARGE samples representing seed purchased by farmers for their own sowing.

The sample submitted should be representative of the bulk and a covering letter should be sent advising despatch of the sample.

MARK YOUR SAMPLE

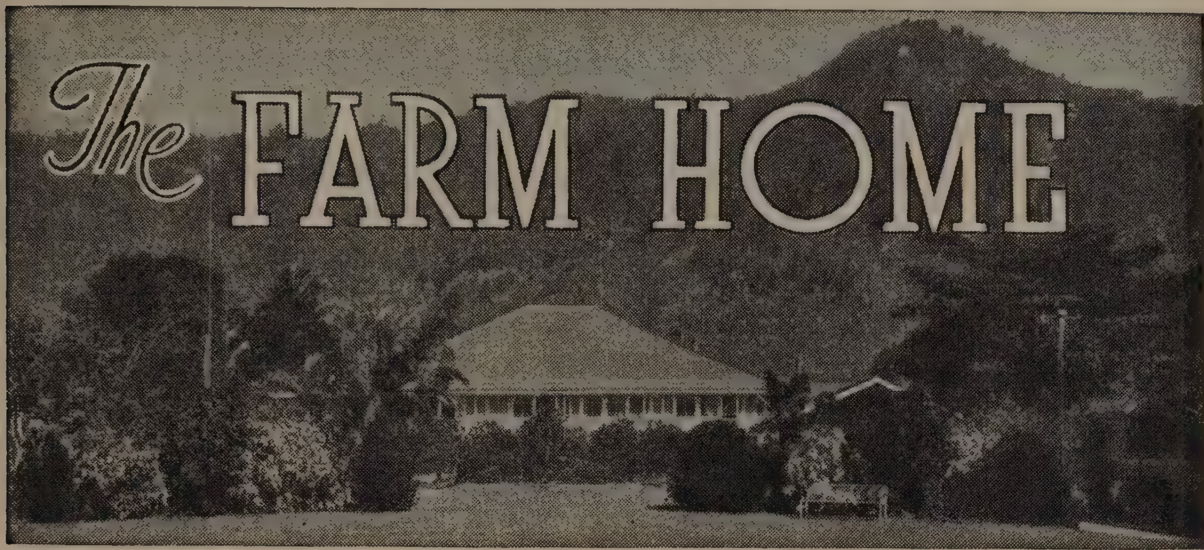
Sample of .... seed
Drawn from .... bags
Representing a total of ....
Purchased from ....
Name and Address of Sender
Date......................

SIZE OF SAMPLE

Barley -	8 oz.	Oats -	8 oz.
Beans -	8 oz.	Peas -	8 oz.
Grasses	2 oz.	Sorghum	4 oz.
Lucerne	4 oz.	Sudan -	4 oz.
Millets	4 oz.	Wheat -	8 oz.

Vegetable Seeds - ½ oz.

SEND YOUR SAMPLE TO—**STANDARDS OFFICER, DEPARTMENT OF AGRICULTURE AND STOCK, BRISBANE.**



Preventing Diseases in Children.

IT has been said that Australia has a greater opportunity of preventing disease than any other country in the world. We might add that there is more scope for practising preventive medicine in children than in any other age group. There is a small percentage of children with congenital defects (that is, some abnormality which is present at birth), and a comparatively small number of children develop diseases of which the cause may be unknown or unavoidable. A great many illnesses from which children suffer are preventable.

Care of the expectant mother logically comes first. It has been proved again and again that regular medical supervision in the antenatal period has reduced maternal and infant mortality and incapacity. Adequate rest, liberal balanced diet and early detection of any abnormal process are the essentials.

Infectious Diseases.

Prevention of infectious diseases is important. Immunisation against diphtheria, whooping cough, and tetanus and vaccination have lowered the incidence of these diseases to a degree that would have seemed incredible when this work started. It is easily forgotten how terrible and fatal diphtheria and tetanus are—so do not neglect to have your child immunised! Tetanus and diphtheria can be completely prevented. Whooping cough is a serious enough disease in itself, but frequently leaves permanent changes in the lungs. Whooping cough immunisation is an essential preventive measure.

With other infectious diseases (scarlet fever, diarrhoea, chicken pox), isolation of known cases is the preventive measure. Keep your child away from known cases and contacts and isolate the patient in the home from other members of the family. Be strict about it! Colds are so common we become resigned to them, but they are often passed on from one member of the family to the next, then the first is reinfected and then the whole cycle begins again. Common sense and reasonable care will stop the spread of colds. Avoid close contact, keep infected handkerchiefs and cups separate, cough and sneeze into a handkerchief.

Build up a resistance to infection. A well-balanced diet with liberal intake of vitamins and proteins is the first essential. Adequate rest and sleep in a well-ventilated bedroom, play and exercise in the fresh air and sunlight are just as important. Do not let children get too fatigued. Keep food fresh and uncontaminated by insects. Attend to the child's clothing, making sure that it is neither too heavy nor too light. Avoid deformities of the feet by choosing correct shoes.

Accidents.

Accidents are responsible for a proportion of illnesses of childhood. Sometimes these seem inevitable, but there are so many lucky escapes that one is inclined to relax one's care and then tragedy occurs. Eternal vigilance is the watchword for adults responsible for children. Keep children away from traffic as much as possible and instill into them the need for care. Always try to have a responsible person with them in heavy traffic. Motorists in their turn should be especially careful when near schools or when children are about.

Children's games need some supervision to prevent risks that are too great. Many climbing and drowning accidents could have been avoided. There are many cases of burns and scalds leaving permanent and crippling scars. One cannot be too careful with stoves, fires, radiators, coppers, kettles or boiling fat.

Finally, regular medical and dental examinations prevent disease or detect it in an early and more easily treatable stage.

Any further information on this and other matters connected with children may be obtained by communicating personally with the Maternal and Child Welfare Information Bureau, 184 St. Paul's terrace, Brisbane, or by addressing letters "Baby Clinic," Brisbane. These letters need not be stamped.

INOCULATION OF LEGUME SEEDS.

★

The Department of Agriculture and Stock supplies cultures of bacteria for the inoculation of seeds of legumes such as Poona pea, blue lupins, lucerne and clovers.

Seed inoculation is often necessary where the legume intended for planting has not previously been grown successfully, as it provides the plants with bacteria which are necessary for their full development.

Cultures are supplied free and post free. They are in bottles and have to be mixed with skim milk for sprinkling on the seed.

Order from the Under Secretary, Department of Agriculture and Stock, Brisbane, at least 10 days before sowing. State amount and type of seed to be treated.

ASTRONOMICAL DATA FOR QUEENSLAND.

SEPTEMBER.

Supplied by W. J. NEWELL, Hon. Secretary of The Astronomical Society of Queensland.

TIMES OF SUNRISE AND SUNSET.

At Brisbane.			MINUTES LATER THAN BRISBANE AT OTHER PLACES.					
Day.	Rise.	Set.	Place.	Rise.	Set.	Place.	Rise.	Set.
	a.m.	p.m.						
1	6.03	5.33	Cairns	27	31	Longreach ..	34	36
6	5.58	5.36	Charleville	27	27	Quilpie	35	35
11	5.52	5.38	Cloncurry	48	52	Rockhampton ..	9	11
16	5.46	5.40	Cunnamulla ..	29	29	Roma	17	17
21	5.40	5.42	Dirranbandi ..	19	19	Townsville ..	22	27
26	5.35	5.45	Emerald	18	20	Winton	38	42
30	5.30	5.46	Hughenden ..	33	37	Warwick	3	4

TIMES OF MOONRISE AND MOONSET.

At Brisbane.

Day.	Rise.	Set.
	p.m.	a.m.
1	2.15	3.33
2	3.26	4.22
3	4.36	5.05
4	5.45	5.43
5	6.52	6.19
6	7.57	6.55
7	9.03	7.31
8	10.07	8.10
9	11.10	8.51
10	..	9.37
	a.m.	
11	12.10	10.26
12	1.06	11.20
		p.m.
13	1.56	12.15
14	2.40	1.11
15	3.19	2.07
16	3.53	3.01
17	4.24	3.55
18	4.53	4.47
19	5.21	5.40
20	5.49	6.33
21	6.19	7.29
22	6.51	8.26
23	7.26	9.26
24	8.07	10.28
25	8.55	11.30
26	9.50	..
		a.m.
27	10.52	12.29
28	11.58	1.24
	p.m.	
29	1.07	2.14
30	2.16	2.58

MINUTES LATER THAN BRISBANE (SOUTHERN DISTRICTS).

Charleville 27; Cunnamulla 29; Dirranbandi 19;
Quilpie 35; Roma 17; Warwick 4.

MINUTES LATER THAN BRISBANE (CENTRAL DISTRICTS).

Day.	Emerald.		Longreach.		Rockhampton.		Winton.	
	Rise.	Set.	Rise.	Set.	Rise.	Set.	Rise.	Set.
1	28	10	44	25	19	0	52	28
6	15	21	31	38	6	12	35	43
11	9	30	25	45	0	21	26	54
16	13	25	28	41	3	16	32	47
21	23	14	39	30	14	5	45	34
26	30	9	46	24	21	0	54	26
30	25	13	41	28	16	3	47	32

MINUTES LATER THAN BRISBANE (NORTHERN DISTRICTS).

Day.	Cairns.		Cloncurry.		Hughenden.		Townsville.	
	Rise.	Set.	Rise.	Set.	Rise.	Set.	Rise.	Set.
1	51	5	65	34	49	20	42	6
3	39	16	56	41	41	26	33	15
5	27	28	48	49	33	34	22	24
7	15	40	40	58	25	43	14	34
9	6	50	35	63	20	49	6	42
11	3	56	34	67	18	53	4	46
13	3	53	34	66	18	51	4	44
15	9	47	37	62	21	47	8	39
17	18	38	42	56	27	41	16	33
19	27	28	49	49	33	35	23	24
21	38	17	56	42	41	27	32	16
23	47	8	63	36	47	21	39	8
25	55	3	68	32	51	18	45	4
27	55	3	68	32	51	18	45	4
29	47	8	63	36	47	21	39	8
30	43	13	59	39	44	24	36	13

Phases of the Moon.—Full Moon, September 4th, 1.19 p.m.; Last Quarter, September 11th, 12.36 p.m.; New Moon, September 19th, 5.22 p.m.; First Quarter, September 27th, 6.31 a.m.

On September 23rd at 12 o'clock midday, Eastern Australian Standard Time, the sun will cross the celestial Equator and on this day will rise and set at true east and true west respectively. On the 5th and 19th the moon will rise and set approximately at true east and true west respectively.

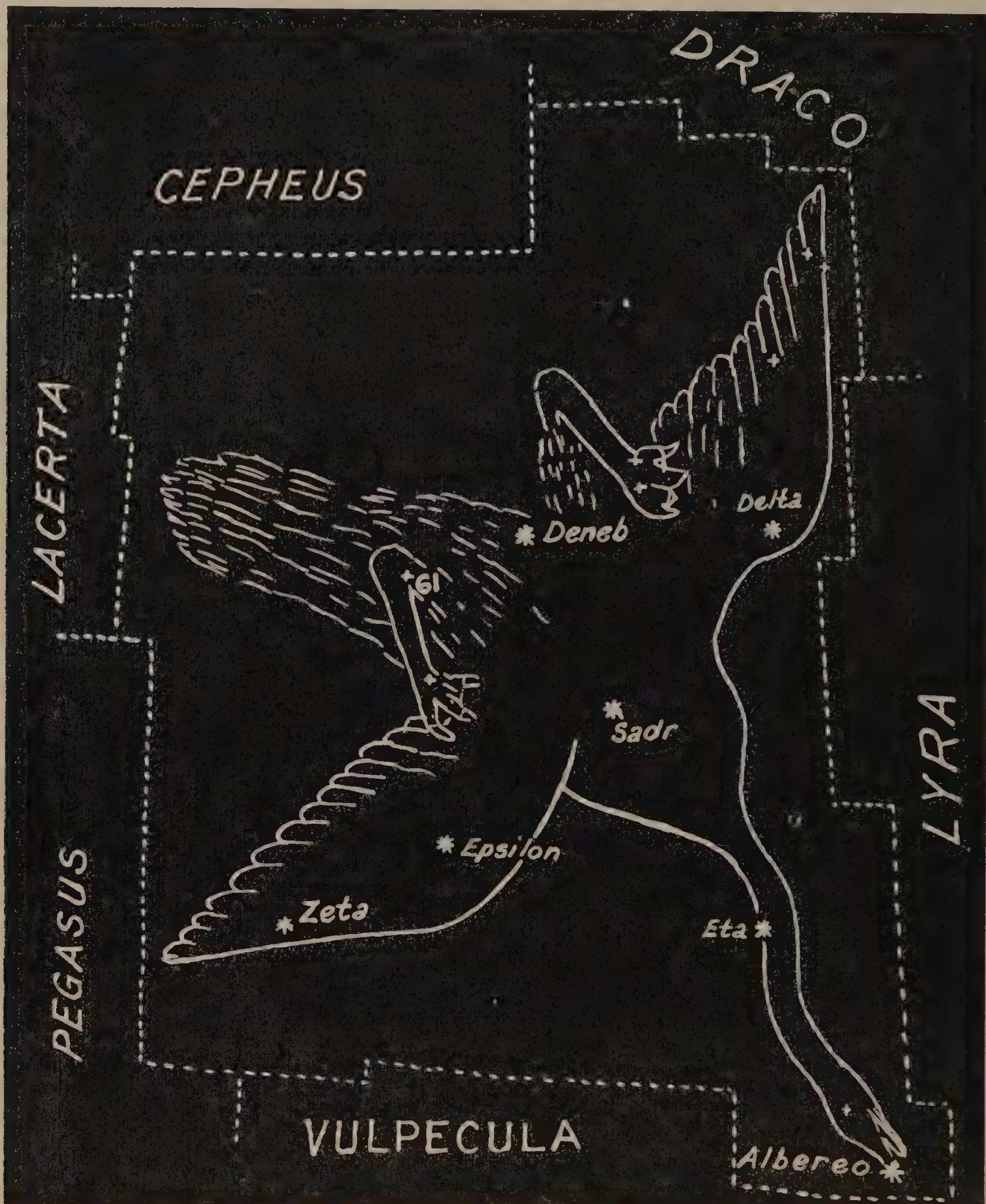
Mercury.—Will be a morning object at the beginning of the month, in the constellation of Leo, when it will rise about 1 hour before sunrise. On the 24th it will be in line with the sun and for the remainder of the month will be an evening planet, on the 30th, in the constellation of Virgo, setting about 20 minutes after the sun.

Venus.—At the beginning of the month, in the constellation of Virgo, will set 1 hour 22 minutes after the sun. On the 16th it will be near Saturn and on the 21st near Spica, the moon also being near on this date. By the end of the month, Venus will set 2 hours after sunset.

Mars.—In the constellation of Scorpio, Mars will set about midnight at the beginning of the month and about half an hour earlier at the end of the month, when in the constellation of Ophiuchus. It will be near Antares on the 11th and the moon will be close by on the 25th.

Jupiter.—In the constellation of Aries, will rise about 1 hour before midnight at the beginning of September and between 9 p.m. and 10.15 p.m. at the end of the month. The moon will be near Jupiter on the 9th.

Saturn.—At the beginning of the month will set between 8.15 p.m. and 9.30 p.m., but by the end of the month will be very low in the west at sunset, when it will set only ¾ hour after the sun. The moon will be near on the 21st.



THE CONSTELLATIONS.

CYGNUS (THE SWAN).

Mythology says that Cygnus, disconsolate at the loss of Phaeton, who was thrown into the River Eridanus for his disastrous driving of the Sun Chariot across the sky, continued to seek him in the river till his persistence so annoyed the gods that they turned him into a swan. This group, quite conspicuous from Queensland, is sometimes known as the Northern Cross and appears to us as a huge inverted cross with its longer axis pointing to the south-west. It is seen best when on the meridian about 8 p.m. in the middle of September. The stars Aridea (Alpha), which is nearest the horizon, and Albireo (Beta) mark the ends of the longer axis of the cross, with Delta on the west and Epsilon on the east marking the ends of the shorter axis and having Sadr (Gamma) at their intersection. Beta is a beautiful double, one being deep yellow and the other greenish blue. Delta is also a double, but a little difficult to separate with small telescopes. As the longer axis of the cross lies in the Milky Way parallel to and almost on the galactic equator, the constellation abounds with interesting doubles, etc. At the remaining angle of a parallelogram made up of Alpha, Gamma and Epsilon is 61 Cygni, a famous double star of 5·3 and 5·9 magnitudes. This was the first star to have its parallax measured directly by Bossel in 1838. It is a binary system with a high proper motion (at right angles to the line of sight) of 9 minutes per century. This star has another claim to fame, for astronomers think it has a planetary system or at least a planet. Having had it under continuous observation for at least 50 years, astronomers know quite a lot about this binary system, the components of which revolve about a common centre of gravity in about 720 years. Each is about half the size of our sun and the larger diameter of their orbit compares with that of the furthest planet of our system. But there is an oscillation in this orbit, which, to compare immense things with small, is like that in the Earth's orbit caused by the moon. It is a very big oscillation. The binary sways east for three years and then goes west for nearly five. The explanation is that this oscillation is caused by an invisible companion. The orbit and dimensions of this invisible companion have been worked out by Dr. Strand in the U.S.A. Its mass has been computed as about 16 times that of Jupiter, but so far there is not sufficient data to say which of the primaries this invisible companion revolves about; it cannot revolve about both. However, it is hoped that with the new Mount Palomar telescope in operation the riddle will be solved.

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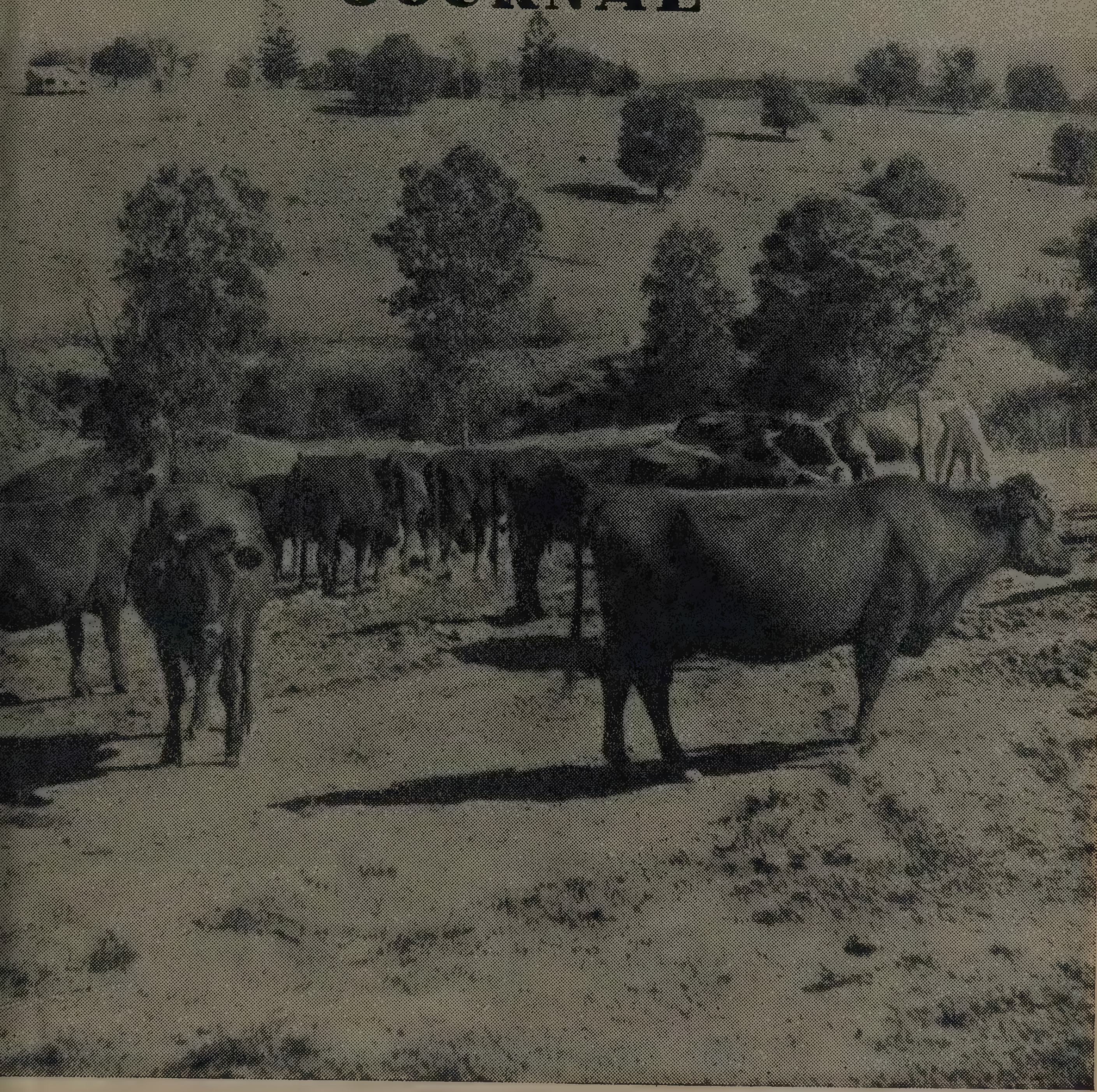

A Beaudesert District Dairy Farm.

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Contents

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ROMA STREET . . . . BRISBANE

The Production of Tobacco Seedlings in the Mareeba-Dimbulah District.

E. W. BAIRD, Adviser in Agriculture.

THE production of well grown, healthy, vigorous seedlings is a necessity if the maximum return is to be achieved from a tobacco crop. In the early years of tobacco production in Queensland, lack of knowledge of seed-bed management and the control of various pests and diseases made the successful raising of seedlings a hazardous procedure. Now the knowledge of these subjects has reached a point at which healthy seedlings can be produced if certain recognised practices are strictly adhered to throughout the life of the plants in the seed-beds.

The construction of seed-beds may vary, depending on whether seedlings are being prepared for an irrigated crop or for one grown entirely under seasonal rainfall conditions. The procedures adopted in each case, however, are fundamentally the same. When grown for the seasonal crop, the seedlings may have to remain longer in the seed-beds, thus unduly exposing the roots to possible nematode attack. In order to avoid this, the concrete tray type of seed-bed is recommended.

SITE AND DRAINAGE.

The site chosen should be in close proximity to permanent water. Water is pumped to a tank from which pipes are laid to the seed-bed area. As detailed attention to the seed-beds forms the early section of the season's activities, it is desirable that the beds also be within reasonable distance of the farm buildings for most efficient working.

The area should be protected as far as possible from prevailing winds, as these quickly dry up moisture and have an adverse effect on the young seedlings. The site should be very well drained, and in no instance should it be situated where water tends to lie.

A new area should be chosen each year owing to the susceptibility of the plant to nematode infestation and the need to avoid infection from soil-borne diseases and tobacco debris carried over from the previous season. It is important from the point of view of mosaic disease that there should be no weeds or vegetables growing near the seed-beds.

SOIL.

Seed-bed soils vary considerably with the locality, but, if possible, a well drained sandy loam should be chosen. It is beneficial for the soil to be of light texture and of a friable nature to allow it to break down to a fine surface tilth when formed into a bed. The ploughing-under of large quantities of grass or green manure immediately prior to the preparation of the seed-bed area should be avoided, as unhealthy seedlings due to "yellow patch" may result.

AREA OF SEED-BEDS.

In the past, it has been the practice to allow 100 square feet of seed-bed area per acre of cultivation. On irrigated farms, however, seedlings can be transplanted as soon as they are ready, and the seed-bed area can consequently be reduced. For an acre of irrigated tobacco, 1½-2 beds, each 10 feet by 4 feet, are sufficient. It is a good practice to transplant into the field at intervals, and seed-bed sowings should be arranged to provide for this.

On non-irrigated tobacco farms, staggered plantings to provide for transplanting when adequate rains occur are necessary. The risk of losses of seed-beds due to the seedlings becoming too old before conditions for transplanting are suitable means that growers have to prepare more seed-bed area per acre of cultivation than is the case on irrigated farms.

Extra provision must also be made for transplanting misses in the field and for unforeseen eventualities. It is far better to have too many seedlings than insufficient for requirements.

SIZE OF SEED-BEDS.

It has been found that beds constructed 10 feet long and 4 feet wide are a very suitable size when using galvanized iron covers or their equivalent for benzol fumigation purposes. They should not exceed four feet in width to allow ease in weeding (if this operation is required) and in lifting the seedlings prior to transplanting them into the field.

As many of these beds as desired may be constructed in line with one another, thus presenting an orderly appearance. It is usual to allow two feet between beds as pathways.

PREPARATION OF SEED-BED AREA.

The first operation in preparing the beds after the site has been selected is to plough the land some months before it is intended to form the beds for sowing. After it has been left in the rough for some time, it is again ploughed, and harrowed to reduce it to a reasonably fine tilth. The area is then sterilized by heat.

After the final preparation, the entire seed-bed area is surrounded by wire-netting to keep out small marsupials, fowls and other straying stock.

STERILIZING THE SOIL.

Careful attention to this phase of seed-bed preparation is essential. The main purpose in applying heat to the seed-bed soil is to destroy nematodes, grass and weed seeds, insects, and diseased plant tissue which may be present in the surface soil. The availability of certain

plant foods in the soil may also be improved, but this is of minor importance. The whole of the seed-bed site, including the pathways, should be sterilized.

Materials commonly used for the production of heat are light bush timber and the central organic material of certain anthills (Plates 62-66). Anthills which contain grass incorporated with the material are undesirable, but unfortunately are the most common type.

Plate 62.

Anthill Prior to Taking out the Inner Matrix.

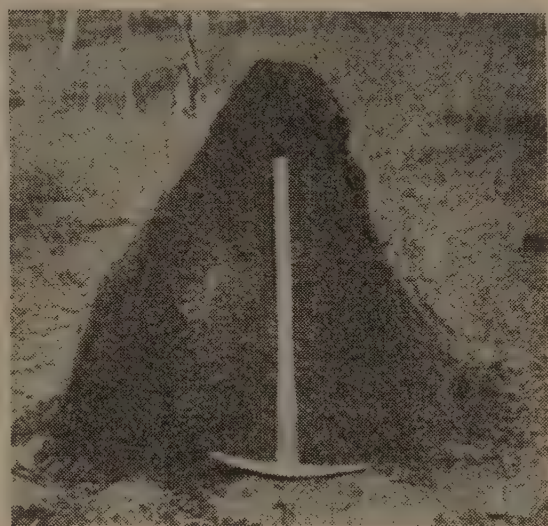

Plate 63.

The Anthill shown in Plate 62 with the Outer Clay Covering Removed. This is the material used for burning on tobacco seed-beds.

Plate 64.

Anthill Material Spread Over Bed Preparatory to Burning.

Immediately prior to burning it is necessary to see that the soil is damp, but not too wet, to secure a thorough steaming effect.

When using brushwood, it is necessary to pile it to a height of one to two feet to secure sufficient heat for the purpose of good soil sterilization. When using anthill material, it should be spread evenly over the entire seed-bed area to a depth of three to four inches.

This depth of material burns slowly and produces an even heat which penetrates and sterilizes the soil to a depth of about five inches. This degree of sterilization is considered satisfactory and is in general use.

Plate 65.

The Anthill Material Shown in Plate 64 Burning. Note the residue of soft white ash.

Plate 66.

Burning Antbed on Tobacco Seed-bed Sites.

As a guide, it may be stated that about four cornsacks full of antbed material will be sufficient for a 10 feet by 4 feet bed. Due allowance will need to be made for pathways. The material is lit by the use of kerosene or by a small fire at the windward corner of the bed.

After the burn, all large ash and any unburnt material should be raked from the area. The beds are then formed by hand and the ash incorporated with the soil.

A modern method of controlling nematodes is the injection of a soil fumigant known as DD. This substance is not a weedicide, and although it controls nematode in the field, the seed-beds must still be treated for weed control. In consequence, its use in seedling production is not favoured.

THE CONCRETE TRAY TYPE OF SEED-BED.

Where it is expected that seedlings will remain longer than usual in the seed-bed before being planted out into the field, a concrete tray type of seed-bed (Plate 67) is satisfactory. This is made 10 feet long and 4 feet wide, so that the covers for benzol fumigation will just fit within the enclosure. Soil is placed within the porous concrete tray, the sides of which are made one brick (or four inches) in height. Allowance must be made for drainage purposes. Sterilization takes place as for the other type of bed as already discussed.

Plate 67.
The Concrete Tray Type of Seed-bed.

The floor of the concrete tray is made 10 feet 8 inches long and 4 feet 8 inches wide to a depth of three inches. The bricks are placed on their long sides around the edges of the floor and held together by mortar to form a firm rectangular shallow tray. The concrete is made from a 5:1 mixture of coarse sand and cement and each bed rquires two bags of cement and half a yard of coarse sand for its construction. No reinforcement is necessary. The outlets for drainage are made by allowing small holes about one inch in diameter to remain under the brick and level with the surface of the concrete floor. Four such holes along each side of the bed have been found to be sufficient.

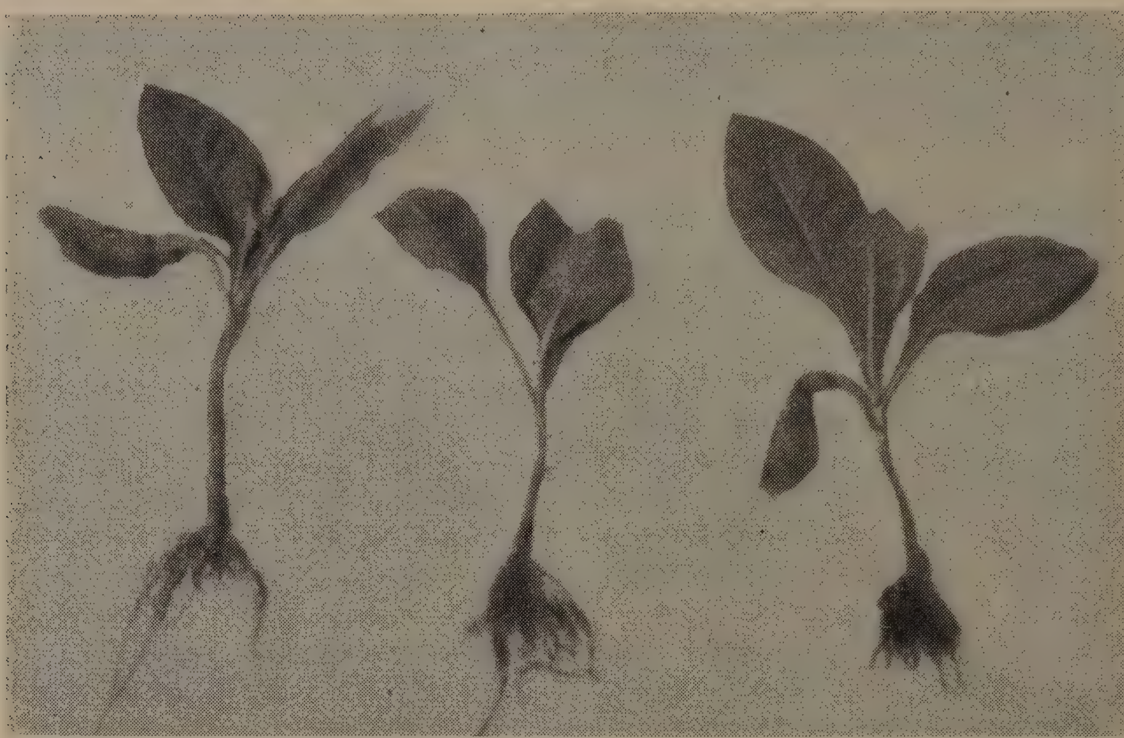

Plate 68.

Seedlings from a Concrete Tray Seed-bed, Showing Root Growth.

The advantage of this type of seed-bed is that, should it be necessary to keep the plants in the beds longer than the usual six-weeks period, they remain free from nematodes. The roots are usually much more numerous and bunched in habit than those of seedlings grown under ordinary conditions (Plate 68). They also lack the large taproot sometimes present in seedlings grown in the normal type of seed-bed. Experienced growers claim that such seedlings give a very high percentage strike in the field.

Benzol treatment is performed with the usual type of cover for fumigation. Experience has shown that the same soil may be used for two years provided the original sterilization is thorough and no soil-borne diseases are present in the first year. These beds have the added advantage of forming a permanent site adjacent to the water supply. When soil in the beds has to be changed, the beds may be emptied and freshly sterilized soil substituted, but it is better to sterilize the fresh soil after it is put in the beds.

SEED-BED FERTILIZER.

After unburnt material has been raked off, the beds are dug lightly to incorporate the ashes into the soil and the surface is then smoothed. The beds may be slightly raised above surface level for drainage purposes.

When fertilizing the seed-beds, great care must be taken not to use excessive nitrogen in any of its organic forms (dried blood, cottonseed meal, animal manures). Otherwise, a condition known as ''yellow patch'' is likely to develop, with disastrous results. It is usual, therefore, to use nitrate of soda as the source of nitrogen. Superphosphate supplies the phosphoric acid, whilst it is considered that sufficient potash has been incorporated with the ash.

A dressing which has been found suitable is up to 2 oz. of nitrate of soda and about 4 oz. of superphosphate per square yard, or, for a 10 feet by 4 feet seed-bed, ½ lb. of nitrate of soda and 1 lb. of superphosphate per bed.

If it is found that the seedlings are not making satisfactory growth, a light dressing of nitrate of soda dissolved in water, 2 oz. to 4 gallons, may be applied. Four gallons of this solution are sufficient for 100 square feet of seed-bed. It is important to water following treatment and to wash any such application off the leaves to avoid burning.

SEED-BED. COVERS.

In the past it was considered advisable to protect the young seedlings from the direct rays of the sun during the early stages of growth, and covers were used for this purpose. However, experience has shown that this is not necessary, and the only covers now employed are airtight and built especially for the application of benzol fumigant for the prevention of blue mould (Plates 69 and 70).

Plate 69.

Well Stacked Galvanised Iron and Plywood Seed-bed Covers.

These covers are made from four 6 feet by 4 feet sheets of flat galvanized iron in such a way that they measure 10 feet long, 4 feet wide, and 1 foot high. Frames of light 2 inches by 1 inch softwood support the iron along the inside of the sides, ends and top. Handles are placed on each end for ease of handling. In making the covers, the seams should be overlapped one inch, rivetted and soldered to make them airtight.

As flat iron is difficult to procure at present, materials such as plywood, building board, bondwood and so on may be used; they make excellent covers provided care is exercised during construction to ensure that all joins are airtight.

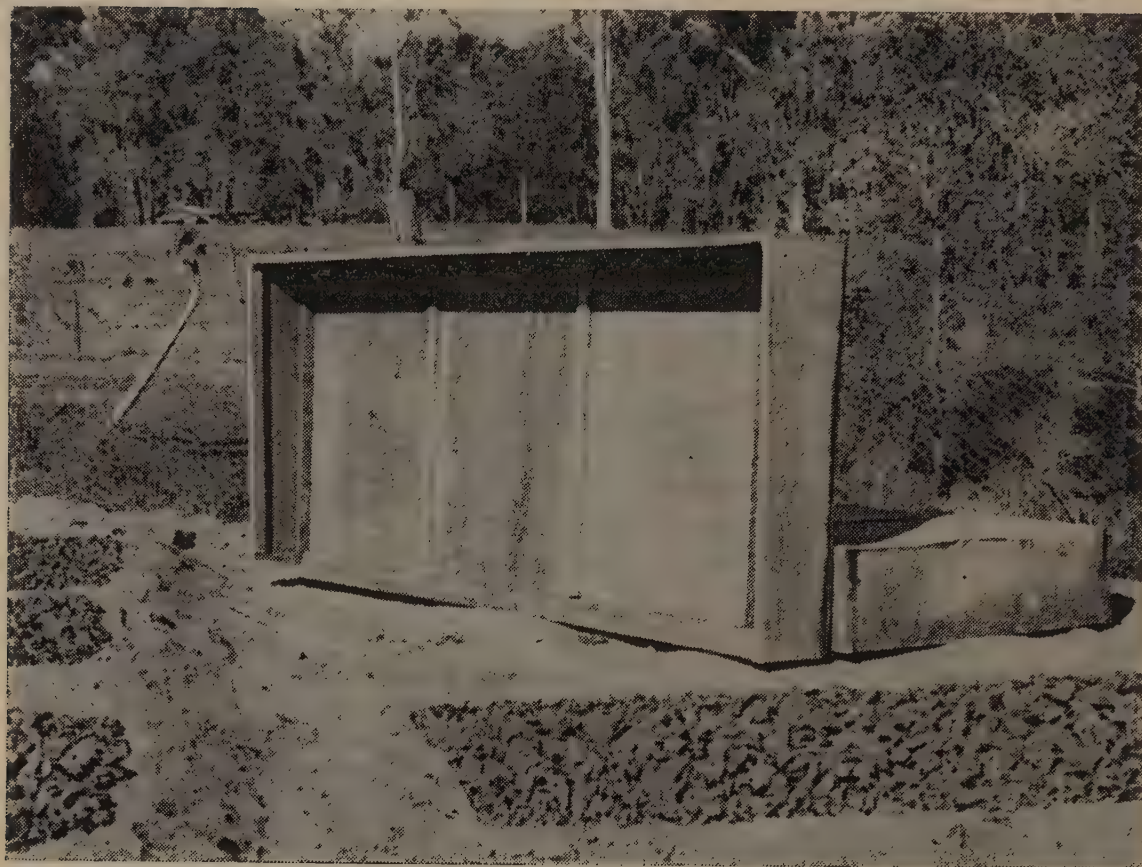

Plate 70.
The Inside of a Seed-bed Cover.

Plate 71.
Beds Presenting an Orderly Appearance, with Covers Ready for Use.

When benzol fumigant is being used for the control of blue mould, the covers are placed in position during late afternoon and removed after breakfast in the morning. When the covers are placed over the beds, soil is brought up all around the edges and ends to ensure that no leakage occurs. When the covers are removed and neatly stacked in the morning, the seedlings should be watered lightly to wash the young leaves and so prevent possible damage.

METHOD OF BENZOL FUMIGATION.

The most serious seed-bed disease is *blue mould* (Plate 72). Dull, showery, cold weather aids the development of this disease and care in watering must be exercised at this time.

Plate 72.

Bare Areas in Seed-bed Due to Seedling Losses Caused by Blue Mould.

Fumigation with benzol under galvanized iron covers overnight, if properly done, will prevent an outbreak of this disease in the seed-beds. The rate at which to use the fumigant is one square inch of evaporating surface of commercial benzol to each square foot of seed-bed. A container with benzol at each end of the bed is more efficient than one large container in the centre, as a more even concentration of gas is obtained by the former method. Two containers, each giving a 5-inch by 4-inch evaporating surface, are sufficient for a 10 feet by 4 feet bed.

The containers are placed on small platforms sufficiently high to raise them above the level of the plants. The depth of benzol in the containers should be such that, when the covers are removed in the morning, only a small quantity remains in the bottom. Experience is the best guide in this respect, as weather conditions govern rate of

evaporation of the benzol. An approximate estimate of the quantity of benzol required is one-half to three-quarters of a pint per 10 feet by 4 feet bed for a 10 to 12-hour fumigation period.

To be effective, fumigation should be carried out at least each third night. However, when the disease is likely to be active (for example, during cold, showery weather), nightly applications may be required. Fumigation should commence as soon after germination as necessary if conditions suggest the likelihood of blue mould infection. It can be employed at any time after germination has occurred. Sufficient gastight covers should be on hand to do this—that is, the number of covers should be at least one-third of the number of beds. Foliage in direct contact with benzol is destroyed, so care must be taken not to spill the liquid on the seedlings.

RATE OF SOWING.

Tobacco seed is very small, about 12 level teaspoonsful being equal to one ounce, and care must therefore be taken that it is not sown too thickly. Thick sowing is undesirable, as the seedlings grow very spindly as a result of competition for light and plant foods; such seedlings are more subject to diseases than sturdy vigorous seedlings and are not ideal for transplanting into the field.

It will be found, therefore, that just under half a level teaspoonful of seed will be sufficient for a 10 feet by 4 feet bed, or 40 square feet.

TIME TO SOW.

The time of sowing is regulated by the time it is desired to set the plants out in the field. On irrigated tobacco farms it is the practice to have plants ready to set out in the field from the beginning of September until the end of October. Plantings are thus staggered over a two-month period in order that labour, barn space and farm operations can be efficiently regulated. In these cases, seed-beds are sown from mid-July to mid-August. Thus seedlings are about six weeks old when ready for transplanting.

Where the tobacco crop is grown solely by rainfall, transplanting into the field may be delayed by the failure of planting rains at the expected period. To meet this situation, a larger area of seed-beds is required than in the case of irrigated crops, and sowing has to be spread more widely so that suitable seedlings are available when adequate rains occur. Sowing of seed-beds for areas in which the seedlings are watered when set out in the field but are subsequently grown under rainfall conditions takes place in October. Those intended for areas where tobacco is grown entirely on rainfall are sown during November and December.

METHOD OF SOWING SEED.

Before the seed is sown it is necessary to see that the seed-bed surface has been raked smooth and freed from all coarse materials and lumps of soil. The soil should be moist and in good tilth before sowing commences.

Due to the smallness of the seed it is the usual practice to place the required amount in a can of water, stir well to keep it in suspension, and water the bed through an ordinary rose, down its length and across its width. This ensures an even distribution of seed over the bed surface.

Another method is to mix the required amount of seed thoroughly with sifted ashes and distribute this evenly over the surface of the bed. The mixture should be firmed into the moist top soil with a flat board.

Plate 73.
Beds Sanded After Sowing.

After sowing, the surface of the bed is covered with coarse sand to a depth of about one-eighth to one-quarter of an inch (Plate 73). This coarse sand mulch prevents seed-harvesting ants from gathering the seed and assists the even penetration of water.

The seed takes about seven days to germinate, depending on time of the year sown. Fine maizemeal is sprinkled over the beds if the young seedlings are attacked by leaf-cutting ants.

Seed of varieties in common use may be purchased from the Department of Agriculture and Stock at the cost of three shillings per ounce (postage paid, cash with order). This seed is sterilized with silver nitrate solution prior to sale for protection against seed-borne diseases.

CARE OF SEED-BEDS.

Beds are watered by using a fine rose on the end of a garden hose, or by a watering can. In the latter instance, it is usual to have a 100-gallon tank adjacent to the beds, and the water is dipped from it as required. Water must be applied as gently as possible, and not allowed

to flow over the surface of the bed. Watering usually takes place twice a day from the time of sowing until the seedlings are an inch or two in height. After this time it may be necessary to control watering in order to stop the plants from growing too quickly, and to lessen the risk of attack by various fungal diseases.

Plate 74.

Well Grown Seedlings Ready for Transplanting into the Field.

The amount of water to use at each watering should be sufficient to keep the surface damp. In this connection, due regard must be paid to prevailing weather conditions. Overwatering must be avoided. Seedlings are ready for transplanting when about six weeks old and four to eight inches high (Plate 74).

Seed-beds should be watched closely so that any development of disease or pest attack can be detected in the early stages and dealt with in the appropriate manner.

Compared with blue mould, other seed-bed diseases are usually of minor importance. Frog eye leaf spot is sometimes serious in seed-beds prepared for the late plantings in non-irrigated fields. In the past, this disease has been controlled by home made cuprous oxide spray applied approximately every five days. However, the Science Branch is experimenting with other types of sprays with a view to simplifying the procedure and growers are advised to contact the Plant Pathologist at Cairns to obtain the latest information on the subject.

Damping-off is a disease caused by a fungus occurring in the soil which attacks the seedlings at ground level, causing them to collapse and die, usually in patches. With good seed-bed management this disease is usually not troublesome, but should it appear it can be checked by one or more applications of Cheshunt mixture, the preparation of which is as follows : Crush 2 parts by weight of powdered bluestone and 11 parts by weight of fresh powdered rock ammonia to a fine

powder. Mix thoroughly and keep in a tightly stoppered glass vessel for at least 24 hours. Then dissolve the mixture at the rate of 1 oz. to 2 gallons of water. Apply this solution to the soil so as to thoroughly wet it. The watering can should be washed out thoroughly after use.

The virus disease known as mosaic is particularly serious when it originates in the seed-bed, and strict attention to seed-bed hygiene is required to avoid its introduction. It must be remembered that this disease can be carried to healthy seedlings on the hands or implements after these have touched diseased plants or manufactured tobacco and from various infected weeds and vegetables by sucking insects. The value of isolating the seed-bed from weeds and the vegetable garden and of carefully washing the hands and implements in soapy water before use in the seed-bed is therefore obvious.

Pest control requires constant attention. A number of insect pests may appear, but the main ones are leaf miner, stem borer and green loopers. At present, DDT and lead arsenate sprays are used for the control of these pests, and growers should ensure that these materials are on hand and that suitable equipment for their efficient application is available. However, investigations into improved methods of pest control are being continued by Science Branch officers, and growers are advised to write to the Department's entomologist at Ayr for the latest information on the subject.

Detailed information on pests and diseases of tobacco seed-beds is contained in publications which are available from Science Branch officers and Advisers in Agriculture at Mareeba, Cairns and Ayr, or from the Science Branch, Department of Agriculture and Stock, Brisbane.

New Book on Pests and Diseases.

A book dealing in a comprehensive manner with pests and diseases of crops and pastures in Queensland has just been issued by the Department of Agriculture and Stock.

Following a general description of the structure of insects, fungi and bacteria, and a chapter on insecticides and fungicides, the book proceeds with a discussion of the pests and diseases of the whole range of orchard and farm crops. The insects, fungi and bacteria concerned are described and illustrated, the symptoms of injury detailed, and control measures given.

There are chapters on deciduous fruits, citrus, banana, pineapple, papaw and other subtropical fruits, cereals, cotton, tobacco, lucerne, potato, tomato, vegetables, pastures and stored products.

The book is available to primary producers in Queensland for ten shillings a copy, and to others for fifteen shillings, post free. It is the second edition of Volume III. of the Department's series of agricultural and pastoral handbooks. Revised editions of the other volumes are being prepared but will not be available for some time.

TUBERCULOSIS-FREE CATTLE HERDS.

(AS AT 11th AUGUST, 1952.)

Breed.	Owner's Name and Address of Stud.
Aberdeen Angus	The Scottish Australian Company Ltd., Texas Station, Texas
	F. H. Hutton, "Bingegang," Dingo
A.I.S.	F. B. Sullivan, "Fermanagh," Pittsworth
	D. Sullivan, "Bantry" Stud, Rossvale, *via* Pittsworth
	W. Henschell, "Yarranvale," Yarranlea
	Con. O'Sullivan, "Navillus Stud," Greenmount
	H. V. Littleton, "Wongalea Stud," Hillview, Crow's Nest
	J. Phillips and Sons, "Sunny View," Benair, via Kingaroy
	Sullivan Bros. "Valera" Stud, Pittsworth
	Reushle Bros., "Reubydale" Stud, Ravensbourne
	H. F. Marquardt, "Chelmsford" Stud, Wondai
	W. G. Marquardt, "Springlands," Wondai
	A. C. and C. R. Marquardt, "Cedar Valley," Wondai
	A. H. Sokoll, "Chelmsford," Wondai
	W. and A. G. Scott, "Welena," A.I.S. Stud, Blackbutt
	G. Sperling, "Kooravale" Stud, Kooralgin, via Cooyar
Ayrshire	L. Holmes, "Benbecula," Yarranlea
	J. N. Scott, "Auchen Eden," Camp Mountain
	"St. Christopher's and Iona" Studs, Brookfield Road, Brisbane
	E. Mathie and Son, "Ainslie" Ayrshire Stud, Maleny
Friesian	C. H. Naumann, "Yarrabine Stud," Yarraman
Guernsey	C. D. Holmes, "Springview," Yarraman
Jersey	W. E. O. Meier, "Kingsford Stud," Rosevale, *via* Rosewood
	J. S. McCarthy, "Glen Erin Jersey Stud," Greenmount
	J. F. Lau, "Rosallen Jersey Stud," Goombungee
	G. Harley, Hopewell, Kingaroy
	Toowoomba Mental Hospital, Willowburn
	Farm Home for Boys, Westbrook
	F. J. Cox and Sons, "Rosel" Stud, Crawford, Kingaroy Line
	R. J. Browne, Hill 60, Yangan
	P. J. L. Bygrave, "The Craigan Farm," Aspley
	A. Verrall and Sons, "Coleburn Stud," Walloon
	R. J. Crawford, "Inverlaw Jersey Stud," Inverlaw, Kingaroy
	P. H. F. Gregory, "Carlton," Rosevale, *via* Rosewood
	E. A. Matthews, "Yarradale," Yarraman
	A. L. Semgreen, "Tecoma," Coolabunia
	G. & V. Beattie, "Beauvern," Antigua, Maryborough
	L. E. Meier, "Ardath" Stud, Boonah
	A. M. and L. J. Noone, "Winbirra," Stud, Mt. Esk Pocket, Esk
	W. S. Conochie and Sons, "Brookland" Stud, Sherwood Road, Sherwood

A SPECIAL RADIO SERVICE FOR FARMERS

★ ★ ★

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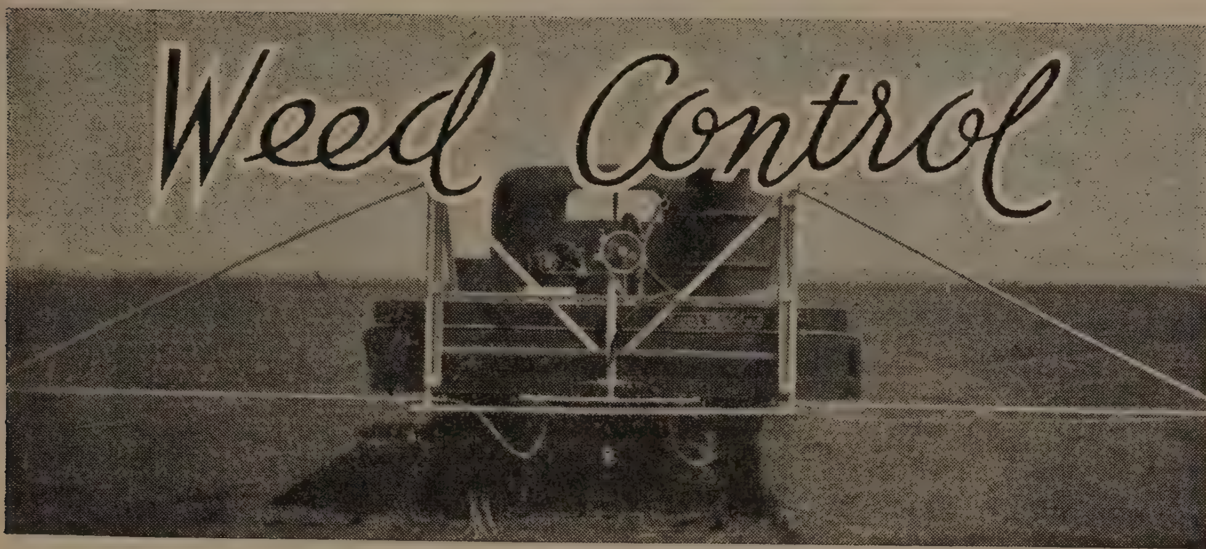


Weed Sprays in Pineapples.

R. C. CANNON, Senior Horticulturist (Plantation Crops).

DURING the past few years methods of weed control in pineapples have undergone a radical change, and the use of PCP sprays has very largely superseded hand chipping.

Sodium pentachlorphenate was introduced to Queensland in 1949 and its possibilities were quickly appreciated. Early experimental work demonstrated that it would prevent germination of weeds and that, with the exercise of a few obvious precautions, it could be used safely in pineapples. Since then, pre-emergence control of weeds in pineapple plantations with PCP has been practised on a commercial scale with consistently good results.

Once weeds are established, PCP has comparatively little effect on most of them, but the addition of a suitable oil emulsion produces a spray which is capable of killing even large broad-leaved weeds. Grasses, however, are more tolerant, and only a partial kill can be obtained at safe and economic concentrations of the oils at present in use.

Forms of PCP.

The term PCP has been loosely applied to two related compounds, pentachlorphenol and sodium pentachlorphenate. The latter is the sodium salt of pentachlorphenol; it is the substance with which growers are more familiar, since it was the material first used in Queensland. As it is soluble in water to the extent of 25 per cent., solutions of sufficient strength for use as pre-emergence sprays are easily prepared, and oil emulsions can be added if a contact spray is required.

Pentachlorphenol, on the other hand, is practically insoluble in water, but is soluble in certain oils, which can be rendered miscible in water by the addition of appropriate emulsifiers. Unfortunately, the oils suitable for the purpose will dissolve only about 15 per cent. of pentachorphenol, and to obtain sufficient PCP in the combined spray entails the use of an unnecessarily large amount of oil.

Pre-emergence Sprays.

For use as a pre-emergence weedicide, sodium pentachlorphenate is dissolved directly in water in the spray vat, and applied at a rate of from 10 to 20 lb. per acre, irrespective of the quantity of water used. About 100 gallons per acre, applied to the bare surface of the ground as a fine mist spray, is usually sufficient for normal requirements. The only precaution necessary is to avoid spraying directly into the hearts of pineapple plants; otherwise injury may result.

The best results are obtained when the ground is reasonably moist at the time of spraying. If it is very dry, and weeds are not likely to germinate in any case, it is usual to postpone spraying until after rain has fallen. If, for any reason, dry soil must be treated, a greater quantity of water per acre would be advantageous. Heavy rain, even if it falls soon after spraying, will have no effect on the result.

The success of pre-emergence weed control depends on the land being clean and free from growing weeds at the time of treatment. PCP applied under these conditions will keep land virtually free from weeds for a period of approximately three months.

PCP-Oil Contact Sprays.

Sprays containing PCP alone, at least at the strengths used for pre-emergence treatment, are of little value as contact sprays and only give a temporary setback to most weeds of any size. The addition of suitable oils, however, results in greatly enhanced toxicity to established weeds. For inclusion in low pressure, high volume spray equipment the oil must mix with water, and this necessitates the inclusion of emulsifiers.

The only oils so far tried in Queensland are diesel oil and creosote. The diesel oil emulsion alone has virtually no effect on weeds at concentrations less than 1 in 30, which is below the danger limit for pineapples. The creosote emulsion is slightly more toxic to weeds, but not sufficiently so for it to be of any consequence in practice. The real importance of both lies in their use in combination with PCP as contact sprays for the destruction of weeds.

Combination sprays of this kind, containing 3 lb. of PCP and 1 gallon of mineral oil or creosote emulsion per 100 gallons, have been found to give complete control of broad-leaved weeds. Grasses are much more tolerant, and raising the concentration of the ingredients to 5 lb. of PCP and 2 gallons of oil is still only likely to result in about a 33 per cent. kill. Grasses which are not killed outright, however, are so severely checked that their removal by hand chipping is thereby greatly facilitated, provided it is done before recovery takes place.

For all practical purposes, diesel oil is just as satisfactory as creosote for the control of broad-leaved weeds, but creosote emulsion is to be preferred if grasses are also involved. Unless grasses are present, there is nothing to be gained by using higher concentrations than are necessary. Where, as is often the case, grasses as well as broad-leaved weeds are present, the higher concentrations will be necessary.

In applying contact weedicides, it is important to completely wet the foliage of the weeds. The quantity required will, therefore, depend on the number and size of the weeds present, and no fixed rate per

acre can be prescribed. In most cases it will be considerably greater than 100 gallons per acre, which is the amount normally required for pre-emergence treatment.

Difficulty may be experienced in preparing PCP-oil emulsion sprays when underground water is used, more especially during drought periods, when the salt content tends to increase. Instead of mixing freely, the emulsion breaks, and free oil, or an oil scum, accumulates on the surface of the mixture. This not only blocks up the jets, but also reduces the effectiveness of the spray. In order to overcome this trouble, the water may be treated with a proprietary water softener, such as Calgon. The hardness of the water will not materially affect its use with sodium pentachlorphenate in pre-emergence sprays, where oil is not included.

The introduction of chemical methods of weed control in pineapples has curtailed labour demands, thereby considerably reducing production costs. Of the methods in use, pre-emergence spraying is pre-eminently the more satisfactory, since the best way to control weeds is to prevent them becoming established. Contact sprays are of particular value in emergency, when weeds have accidentally got out of hand.

INDUCING FLOWERING IN THE SUMMER PINEAPPLE CROP.

Flowering for the summer crop usually begins about the last week in August in south-eastern Queensland and extends until the third week in September, but the period varies somewhat according to weather conditions. In all vigorous plant crop areas there are some large plants, known as ''hold-overs,'' which for some obscure reason fail to flower naturally. These plants should be ''gassed'' over a period of a month, commencing in the fourth week in September and carrying through to the end of the third week in October. The treated plants will flower six to eight weeks later and harvest good quality fruit from May to June. On the ratoon areas, all large and vigorous suckers which have not flowered can also be ''gassed'' during the same period.

''Gassing'' of undersized plants produces small fruit borne on a long stalk, and the sucker growth is both slow in developing and very weak.

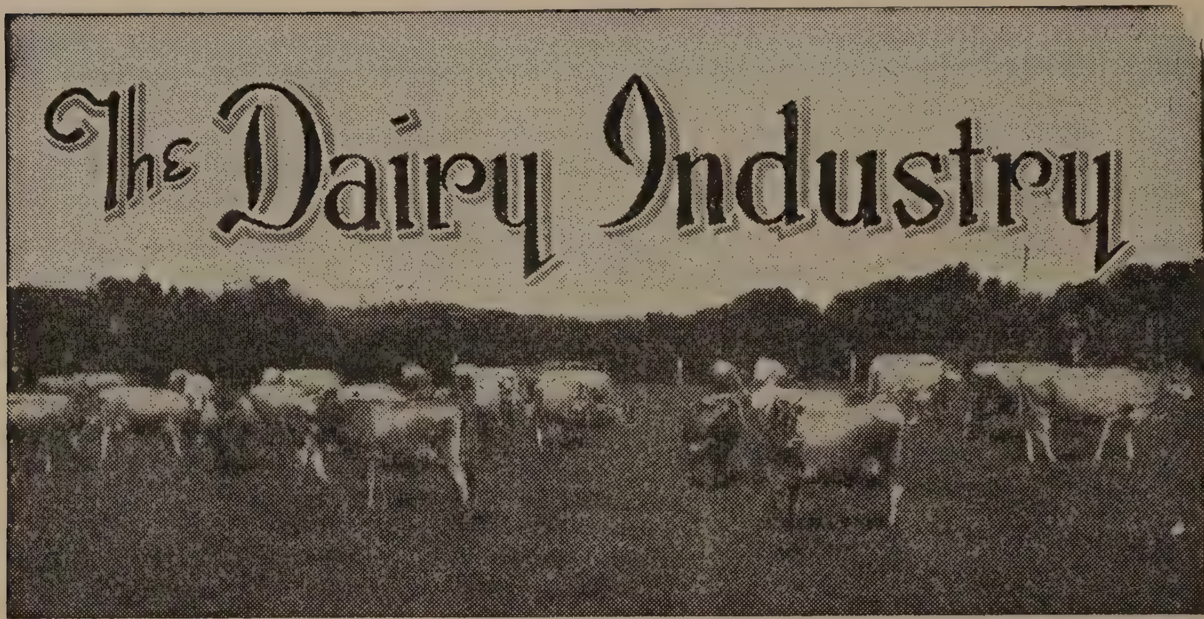
Details of the ''gassing'' treatment, using either alpha naphthalene acetic acid (ANA) or acetylene, may be obtained from district officers of the Department.

CONTAMINATION OF MOLASSES.

Before farmers feed molasses to stock they should make sure the drum used as a container has not been contaminated by poisonous substances or residues.

Many stockowners have complained that molasses caused sickness and mortality amongst pigs and calves, and investigations made by officers of the Chemical Laboratory have proved that the use of contaminated drums for holding the molasses was the root of the trouble. Drums that had been used for holding carbolic mixtures, paint, and dangerous preservatives often were used again for storing molasses without first being thoroughly cleaned. The result was the illness or death of stock from lead or other forms of poisoning.

Farmers are advised to examine carefully drums bearing stencil marks. Strong lysol or carbolic odours and paint-like ''skins'' of dried oil are also danger signals. ''Return'' drums known to be safe are the best to use for holding molasses. In the case of containers being used for the first time for molasses the farmer should see that they are thoroughly cleaned before use. Mere steaming is not sufficient.



Observations on Dairying in Pakistan.*

E. B. RICE, Director of Dairying.

THE milch animal and man have been interdependent on the Indo-Pakistan Sub-Continent for generations. In Pakistan the agrarian section, which represents over 80 per cent. of the total population, all keep stock of some kind. Even within the boundaries of cities and towns, cows and buffaloes are kept in large numbers.

Cattle, buffaloes, sheep and goats all contribute to the milk supply of the nation. There are 46 million of these animals, consisting of 24 million oxen, 6 million buffaloes, 10 million goats and 6 million sheep. Females of these different species number 21 million. The milk of goats and sheep is chiefly used for the domestic needs of their owner or for making ghee, although goats' milk is commonly mixed with other milk for sale purposes. Sheeps' milk is not marketed as fluid milk.

The human population of Pakistan is estimated at 76 million, of which 34 million are in West Pakistan (area 307,000 square miles) and 42 million in East Pakistan (area 54,000 square miles). These two wings of the country are separated from each other by 1,000 miles of Indian territory. The average yield of milk per animal is low due to underfeeding, poor management and diseases; so despite the large number of milk-producing stock, there is a serious deficiency of milk and milk products.

The total yearly production of milk is about 1,250 million gallons, while to enable a daily per capita consumption of one pint (the quantity recommended by nutritional authorities as a desirable level of consumption), about 3,500 million gallons would be required.

Some 46 per cent of the total milk yield is produced by buffaloes, 42 per cent. by cattle and the remainder by goats and sheep. Buffalo milk is of even greater significance in the dairying economy of the country than its actual quantitative production suggests, as its average fat content is 6.5 per cent.

Dairy farming by a farmer who owns a large herd of cattle and is primarily concerned with dairying as a means of livelihood is almost non-existent in Pakistan. The keeping of milch animals is a sideline to

* The author this year spent two months in Pakistan under the Technical Co-operation Scheme of the Colombo Plan.

Plate 75.
A Village Dairy.

other agricultural pursuits, only a few females being kept by each individual owner. Moreover, the land is generally worked under a peasant farming system, each cultivator working only a few acres of land, but in every case having some livestock. Except in villages within reasonably close proximity to the towns (usually not more distant than 20 miles), cows are kept more for the rearing of working bullocks than for milk yield, as bullocks are almost solely used for draft purposes on farms in Pakistan, which has virtually no mechanised agriculture. This dual objective of keeping cows for the rearing of working bullocks and milk yield has to be clearly kept in mind in connection with any livestock improvement schemes.

In East Pakistan, in particular, there are very difficult problems to be confronted in connection with all food production. Only one-sixth of the total area of Pakistan, it contains over half the total stock and human populations. It is one of the most densely populated areas of the world. There are 778 people and 760 head of livestock per square mile. Consequently, the competition between the people and the livestock for the inadequate foodstuffs necessitates the livestock being maintained predominantly on paddi straw and other residues from crops, the grain of which is required for the human population. In this province, about 50 per cent. of the holdings are less than two acres, 25 per cent. between 2 and 5 acres, and only about 25 per cent. over 5 acres.

The annual rainfall in East Pakistan is over 100 inches. In most of West Pakistan it ranges from about 7 to less than 20 inches and its distribution is restricted practically to the summer monsoon period of about three months, the remaining months being almost rainless. However, extensive irrigation schemes have enabled the conversion of millions of acres of land which were formerly semi-arid into fertile farmlands, intensively cultivated and comparatively heavily stocked. A visitor from Australia could not fail to be impressed with the wonderful potentialities of the national water conservation policy. Most of the irrigation waters are derived from rivers which have their sources in the permanently snow-capped Himalaya Mountains.

The density of oxen and buffaloes in West Pakistan is shown in Table 1.

TABLE 1.

DENSITY OF OXEN AND BUFFALOES IN WEST PAKISTAN IN 1940.

Province.	No.	Percentage of Total.	Percentage Females.	Number per 100 Acres Cultivated Land.	Number per 100 Persons.	Number per Square Mile.
Punjab—						
a	5,332,000	62·1	40·6	33	34	86
b	3,485,000	76·3	79·7	23	22	57
Sind—						
a	1,783,000	20·7	53·1	18	39	38
b	593,000	13·0	85·7	6	9	20
North West Frontier—						
a	762,000	8·9	42·4	28	25	56
b	271,000	5·9	83·8	10	13	13
Bahawalpur—						
a	706,000	8·3	N.A.	35	53	40
b	221,000	4·8	N.A.	11	16	13
West Pakistan—						
a	8,583,000	100·0	45·4	29	38	55
b	4,570,000	100·0	83·0	13	15	26

a = cattle ; *b* = buffaloes.

Source :—Publication No. 103, Livestock Survey in Punjab, Board of Economic Inquiry, Punjab, 1951.

BREEDS AND BREEDING.

Pakistan is fortunate in possessing certain breeds of cattle and buffaloes well adapted to the tropical environment and suitable for draft or milk purposes according to the specific requirements.

The different breeds are shown in Table 2.

TABLE 2.

BREEDS OF CATTLE AND BUFFALOES.

Kind of Animal.	Breed.	Type.
Cattle	Sahiwal	Milk
	Red Sindhi	Milk
	Tharparkar	Dual purpose
	Lohani	Light draft
	Dhanni	Medium draft
	Dajal	Medium draft
	Bhagnari	Heavy draft
Buffaloes	Nili	Milk
	Ravi	Milk
	Kundi	Milk

There being no distinct breeds of beef cattle, animals of all breeds are killed for meat. Buffalo meat, which is coarse, is bought mainly by the poorer people.

Since male buffaloes are slow and lethargic, they are not used extensively as draft and working animals.

All of the breeds of cattle belong to the hump-backed Zebu type. However, it is unnecessary for the purpose of this article to describe the colour, size and other characteristics of the specific breeds of cattle and buffaloes. Typical specimens of some of the breeds are shown in the illustrations.

Plate 76.

A Milking Buffalo. This animal is one of the highest producers in Pakistan.

Plate 77

A Bhagnari Bullock. This is an active, heavy draught breed.

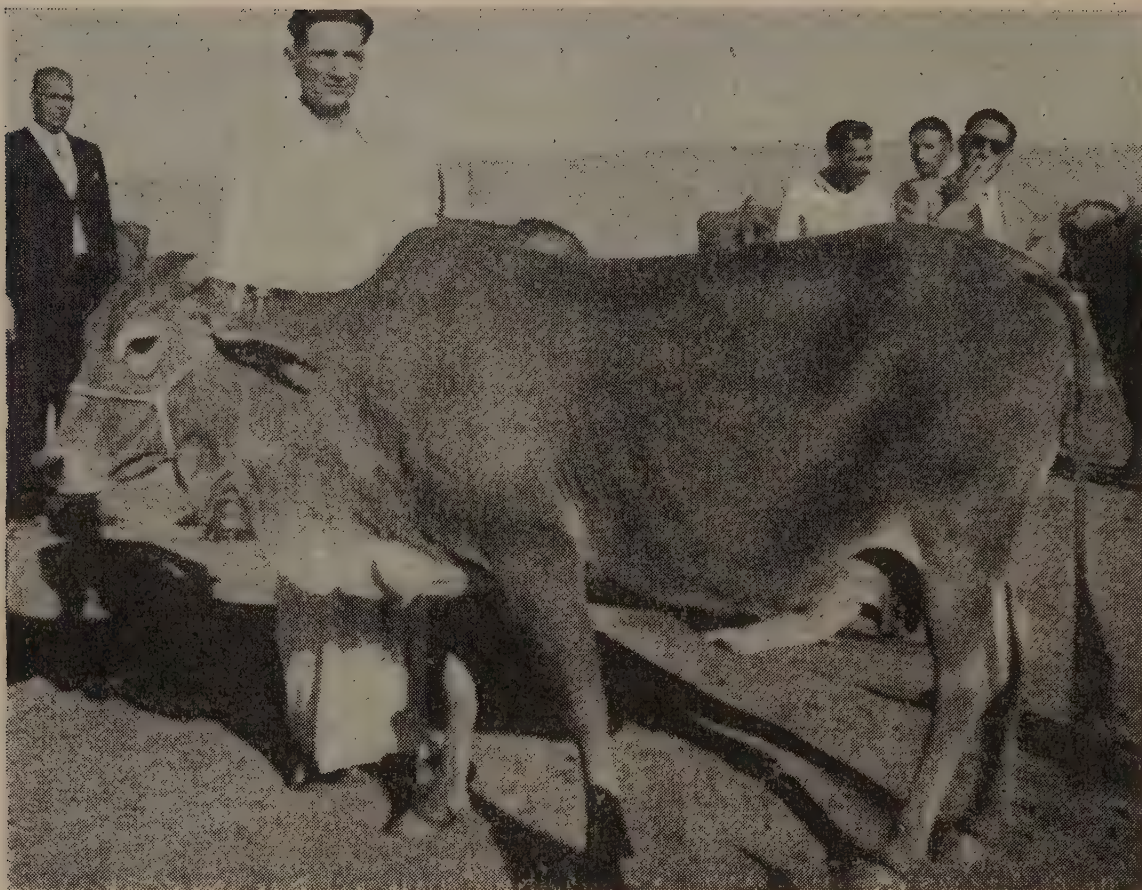


Plate 78.

A Sahiwal Heifer. The breed is the highest milk-producing breed.

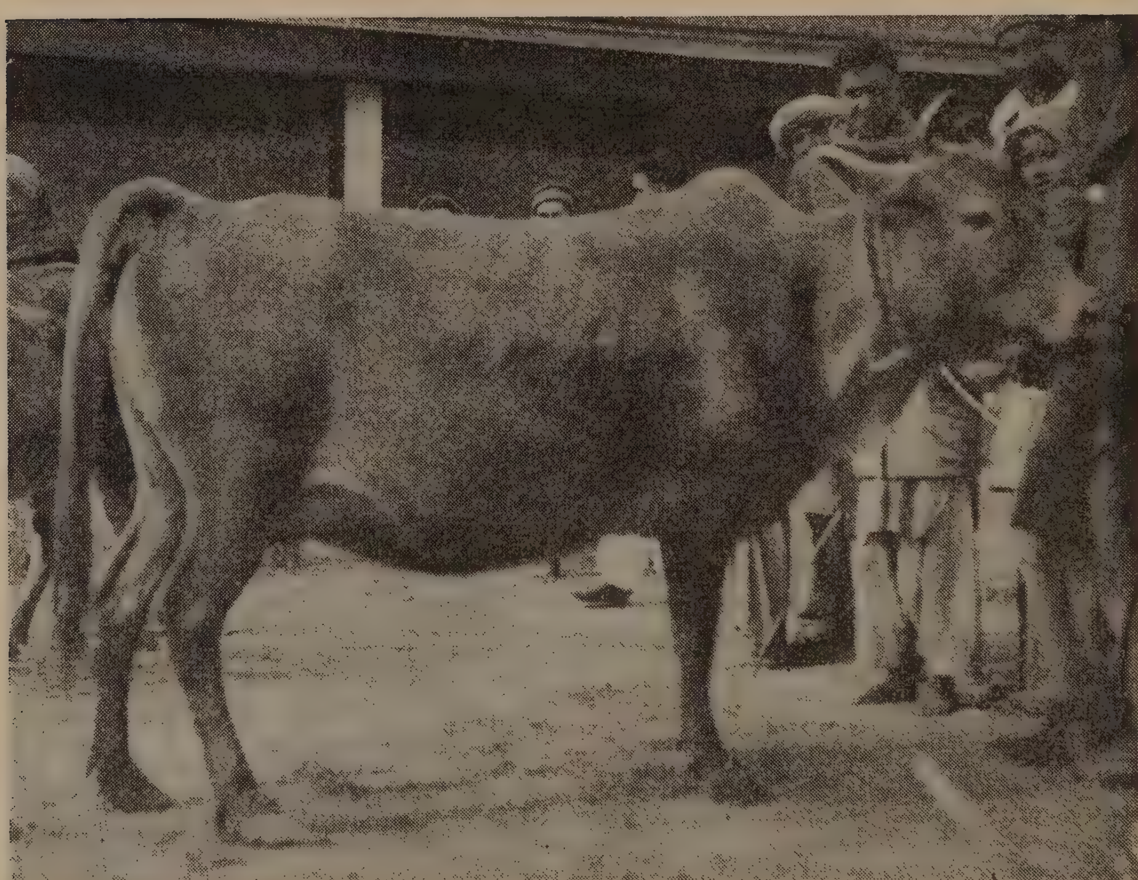


Plate 79.

A Red Sindi Cow. This is one of the best indigenous milk breeds.

Plate 80.

A Typical Nondescript Cow (Desi Cow) in East Pakistan.

Climatic features of three towns typical of the dairying districts of Pakistan are shown in Table 3.

TABLE 3.

CLIMATIC FEATURES OF THREE TOWNS TYPICAL OF DAIRYING DISTRICTS.

Place.	Mean Annual Temperature.	Rainfall.
	(°F.)	(Inches.)
Karachi	78·2	9
Lahore	75·1	20
Chittagong	77·2	108

MEAN MONTHLY TEMPERATURES.

—	Jan.	Feb.	Mar.	Apr.	May.	June.
West Pakistan—						
Karachi	63·4	66·7	75·2	82·7	86·3	85·1
Lahore	54·0	58·8	66·8	78·9	88·0	92·5
East Pakistan—						
Chittagong	66·9	70·5	72·1	81·0	82·2	81·8

—	July.	Aug.	Sept.	Oct.	Nov.	Dec.
West Pakistan—						
Karachi	85·3	83·3	83·0	81·4	74·8	67·4
Lahore	89·8	87·8	85·2	76·9	65·1	56·0
East Pakistan—						
Chittagong	81·3	81·1	82·8	80·1	74·5	67·1

It has been suggested that the upper limits of mean annual temperature to which European breeds of dairy cattle may be acclimatised are 65-70 deg. F. It will be seen that the mean annual temperatures in both West and East Pakistan are above this range. Except in three months, the individual monthly mean temperatures are also above 70 deg. Animals therefore obtain little respite from enduring high temperatures in Pakistan.

Cross-breeding between the indigenous and European breeds of cattle is followed only on a few farms operated by the Army to supply milk and dairy produce for the armed services. European breeds of cattle, which have a heat-regulating system different from indigenous cattle, suffer a physiological disturbance in a tropical environment and are highly subject to acute infectious tropical cattle diseases to which indigenous breeds are more resistant. Experience in Pakistan and other tropical countries has shown that the cows resulting from the first cross between European and indigenous stock give satisfactory milk yields if properly fed, but thereafter further crossing leads to impaired constitution and lower milk yields. The relationship between climate and the performance of dairy cattle has only received serious study in recent years and the published information is far from conclusive. The investigations do, however, indicate the superiority of indigenous cattle over breeds of European origin in a tropical environment. In Pakistan there are herds in which cows of the Sahiwal and Red Sindhi breeds have produced milk yields which are creditable in comparison with those of most cattle in other dairying countries and which have thus shown the potentiality for high milk yield of cows of these particular breeds. The advisability of improving the indigenous breeds by scientific breeding, feeding and care, rather than by encouraging the use of European breeds alone or for cross-breeding with indigenous stock, appears indicated in the light of recent investigations overseas on cattle breeding in the tropics.

MILK PRODUCTION.

Milk Yields.

Indiscriminate breeding, improper and inadequate feeding, and general lack of knowledge of the principles of animal husbandry among the peasant cultivators are responsible for the low average milk yield of stock in Pakistan. The average for the country is probably about 50 gallons yearly for cows and 100 gallons for buffaloes, although there are marked differences in the various provinces. For example, in the Punjab, the premier dairying province, the estimates are 140 gallons and 220 gallons respectively for cows and buffaloes. On the other hand, it was obvious from records perused at military farms and some Government institutions that the indigenous stock have potentialities for high yields if managed under scientific conditions. The average lactation yield of 49 Sahiwal cows in the herd of the Lyallpur Agricultural College was just over 700 gallons, which is creditable in comparison with the yields of well managed herds of European breeds in countries enjoying a temperate climate. The average fat content of the milk of the indigenous cattle is 4·5 per cent. and of buffaloes 6·5 per cent., which, having regard to the place of ghee in the dairying economy, makes the performance rather better than the milk yields alone suggest.

Milk Recording and Herd Book Registration.

Prior to the partition of India and Pakistan in 1947, milk-production recording and herd book registration schemes for several breeds of cattle and one breed of buffalo were in operation, but they were discontinued in Pakistan after that time. The lack of these schemes constitutes a serious deterrent to raising productive standards, as a register of animals and records of breeding and milk yields are now kept only on the few Government and military farms.

Distribution of Selected Bulls.

Provincial Governments are encouraging stock improvement by providing pedigree bulls to certain landowners free of cost, or at a price much below the market value. In some cases a landowner is also granted a subsidy to maintain a bull. Superior bulls and male buffaloes are also kept at some veterinary hospitals for servicing the cows and she-buffaloes of villagers free of charge or at a low cost per service.

Some local authorities also maintain male buffaloes and bulls to assist city cattle owners to improve their stock by using better bulls for breeding purposes. A charge of 2 rupees per service is made, whereas owners of inferior bulls may charge 5 rupees.

Laudable as these efforts are, there is need for considerable expansion before any real benefit can accrue, the number of better bulls supplied under these schemes being quite inadequate for the needs of the country.

Much interest is being evinced in the possibilities of artificial insemination under Pakistan conditions, where although there are heavy concentrations of cattle, each owner has only a few animals and cannot afford to keep a superior pedigree bull or male buffalo. An artificial insemination centre has already been established in East Pakistan.

Further investigations are planned at a livestock experimental farm recently established in West Pakistan with finances provided from Commonwealth countries. If the trials prove successful, there appears to be a nucleus for widespread extension through the network of veterinary hospitals which have been established by the various provincial Governments throughout Pakistan.

Feeding.

Any substantial increase in the overall milk production of Pakistan, to ensure that there will be available in the country a more adequate quantity of milk at a cheaper price, will depend rather on measures designed to raise the average milk yield per animal than on increasing the stock population, and as a short-term policy this can be achieved most readily by better feeding practices. Moreover, as the ability to grow and/or produce milk to its inherent capacity can only be realised if the plane of nutrition of an animal is optimal, emphasis cannot be placed on improved breeding practices as the first step towards raising the productivity of individual milk stock of the country.

In Pakistan pasture plays an insignificant role in cattle husbandry, the only grazing of grasses being in forest areas, where grazing rights are hired by stock-owners. Certain straws, such as wheat and rice, and fodder crops are the staple animal fodders. Fodder crops are usually hand-cut in the field and carried to the stock. Concentrates are fed to milch stock by producers supplyling milk for the town milk trade

and by villagers in some districts, especially to buffaloes. The amount fed is not according to recognised feeding standards. Under-feeding is general during all seasons of the year and the principles of scientific feeding are scarcely known among cattle owners.

After hand-cutting in the villages, all green fodder for stock kept in towns has to be transported to the towns by means of cart or bullock dray. Apart from the danger to public and animal health, the nuisance and insanitation inseparable from large concentrations of stock in over-congested towns, this uneconomic method of feeding town stock forces the price of milk so high as to restrict the amount purchased by most people and fosters malpractices which are often adopted to offset high production costs.

Crops grown commonly in Queensland, such as wheat, sorghum, millet, barley and maize, are among the principal fodder crops of Pakistan. Some excellent legumes, especially berseem clover and other tropical varieties, are grown in the irrigated tracts in West Pakistan. They play a dual role in improving soil fertility and providing a valuable protein-rich green fodder readily eaten by stock.

The area under crops in 1948-49 is shown in Table 4.

TABLE 4.

AREA UNDER FODDER CROPS IN PAKISTAN IN 1948–49.

Province/State.	Area (in Acres).
Provinces.	
East Bengal	84,000
N. W. Frontier	96,000
Punjab	2,599,000
Sind	256,000
States.	
Bahawalpur	362,000
Khairpur	35,000
Total	3,432,000

Animal Health.

Measures for the protection of animal health have been well developed by the Central and Provincial Animal Husbandry Departments. There is a network of well equipped veterinary hospitals throughout the country, staffed by qualified veterinary officers and assistants, at which advice, treatment and medicines are given free of cost.

Certain diseases which affect the economic usefulness of milch stock and cause reduced milk yields are of a serious nature. From the viewpoint of loss of milk production, the more important diseases are rinderpest, foot and mouth disease, haemorrhagic septicaemia, anthrax, black quarter (blackleg), liver fluke, ox warble fly and internal parasitic diseases of young stock.

Rinderpest.—Outbreaks of severe intensity occur from time to time. The disease is usually fatal. A vaccine is prepared by the Pakistan Animal Husbandry Research Institutes at Peshawar and Dacca.

Foot and mouth disease is endemic, and although not usually fatal, causes lowered milk yield in female stock and much loss of working time among draft bullocks.

Haemorrhagic septicaemia is prevalent, particular among buffaloes. It is frequently fatal and the milk yield is seriously depressed.

Anthrax is common in all districts.

Ox-warble fly causes lowered milk yield through irritation, and the value of hides is greatly depreciated.

Liver fluke causes lowered milk yield due to loss of condition of the animal. It is confined to stock in irrigated districts, where a high proportion of animals become infected. The incidence is higher in buffaloes than in cattle.

Sterility.—There are no reliable data on the incidence of brucellosis and other sterility diseases, but inquiries indicated that sterility is a problem of some magnitude.

Bovine tuberculosis and *Johne's disease* are also relatively common.

Mastitis was reported to be less troublesome than in many other countries, although instances of high incidence in some herds were cited.

Diseases of Young Stock.—Malnutrition far exceeds in importance all other diseases among calves and young stock and is in large measure a contributory factor to their incidence. *Dysentery* takes a serious toll; if not fatal, it retards the future growth and productivity of affected animals. *Internal parasites* also are responsible for serious difficulties in the rearing of calves and young stock, particularly in East Pakistan.

Calf Rearing.

As in many other dairying countries, calf rearing in Pakistan is a neglected phase of animal management, the main features being unsuitable housing, improper nutrition and poor sanitation. In the wet, low-lying areas of East Pakistan, internal parasitic diseases take a heavy toll of calves and impair the growth and stamina of survivors.

Buffalo calves at birth weigh from 60 to 80 lb. for females and 70 to 90 lb. for males. According to breed, calves of cows weigh from 50 to 60 lb. Sahiwal calves born at Lyallpur Agricultural College have averaged 50 lb., males weighing 52 lb. and females 48 lb. The rate of growth to maturity is slow. Inadequate feeding and, in East Bengal, parasitic ailments are considered the main hindrances to fast growth.

Milch animals in Pakistan are always milked by hand; there is not a single milking machine in the country. The milch cows and buffaloes are usually quite docile. Villagers allow the calf to suckle its dam until it is weaned at six to eight months of age, having a superstitious belief that the cow will not "let down" milk unless the calf is at foot. The falsity of the notion has been demonstrated on military and Government farms where calves are pail fed and where, incidentally, no trouble is experienced in calf rearing by this method or in the letting down of milk by the cow or buffalo. Less milk taken by the calf up to the weaning stage would give more milk for domestic and other purposes.

In the towns most calves born are not reared. This is another serious drawback to general herd improvement because the cows and she-buffaloes there are above average quality. If calves are reared in towns they frequently suffer from dysentery, other ailments and general unthriftiness due to improper feeding and neglect. Consequently, mortality is high. It was stated that 50 per cent. of the calves born in the city of Lahore die and half of the remainder become so unthrifty as to necessitate culling before attaining milking age.

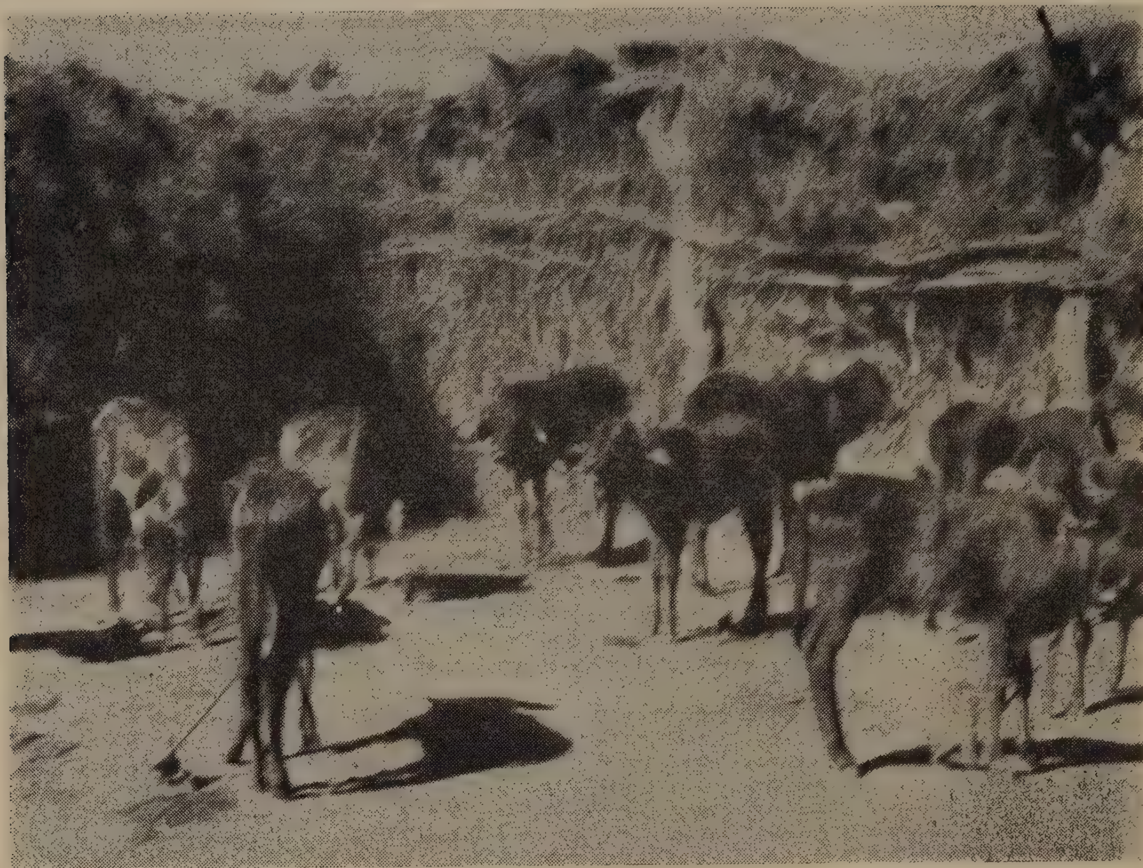


Plate 81.
Red Sindi Calves.

The conditions in Pakistan are so dissimilar from those in other countries where improved calf rearing practices have been developed as to limit the usefulness of adopting such methods in their entirety. Since the proper rearing of calves so materially influences the milk-yielding capacity of the animals in their ensuing productive period, local research appears necessary to determine the methods most applicable in Pakistan.

Other Aspects of Herd Management.

In a well managed herd the aim should be to have the animals calving yearly and milking for nine to 10 months with a dry period of two to three months between lactation periods. Short lactation periods with long dry intervals are to be avoided, as the longer the animal is unproductive between lactations, the lower is the lifetime milk yield and consequently the higher the cost of production. The average lactation period in West Pakistan is 200 days for cows and 300 days for buffaloes, while in East Bengal the lactation period is of about the same duration, but the dry period was stated to be 12 months. On the other hand, there is evidence that by improved management the lactation period of animals in Pakistan can be lengthened.

The average lactation period of 49 Sahiwal cows in the herd of the Lyallpur Agricultural College was 366 days and the dry period 70 days.

Cows and she-buffaloes do not normally produce their first calf until three and four years of age respectively.

The Zebu breeds of cattle have a longer gestation period than European breeds. The gestation period of Sahiwal cows in the Lyallpur Agricultural College herd averaged 292 days, with a minimum of 280 days and a maximum of 300 days, in contrast with the average gestation period for cows of European breeds of 280 days.

There is usually no attempt made to regulate the calving periods in order to ensure that the peak of production will coincide with the months when fodder supplies are most abundant and at their stage of high nutritive value, although the distribution of calvings among cows is higher from November to January and among buffaloes from July to September. This difference in the months of higher calvings of cows and buffaloes helps to maintain a more uniform supply of milk.

From the meagre published data and observations on some farms, the possibility of achieving earlier and more regular calvings seem indicated.

Cattle and buffaloes in Pakistan appear to have longevity, as some animals inspected were still productive at up to 17 years of age. However, cattle and buffaloes kept in cities are frequently slaughtered after completing only one lactation. As the better stock are eagerly sought by city stock-owners, the drain on the disproportionately low numbers of above average quality stock is a factor impeding progress in raising productive standards.

Hygiene of Milk Production and Handling.

The principles of hygienic milk production are little understood in Pakistan, and consequently milk is generally produced under conditions which are much below a reasonable standard of hygiene. The very numerous keepers of dairy stock, illiteracy and poverty, which precludes the purchase of proper equipment, all make the introduction of the modern concept of clean milk production a complex problem, but to ensure the availability of a healthful, high quality milk supply, it cannot be deferred much longer.

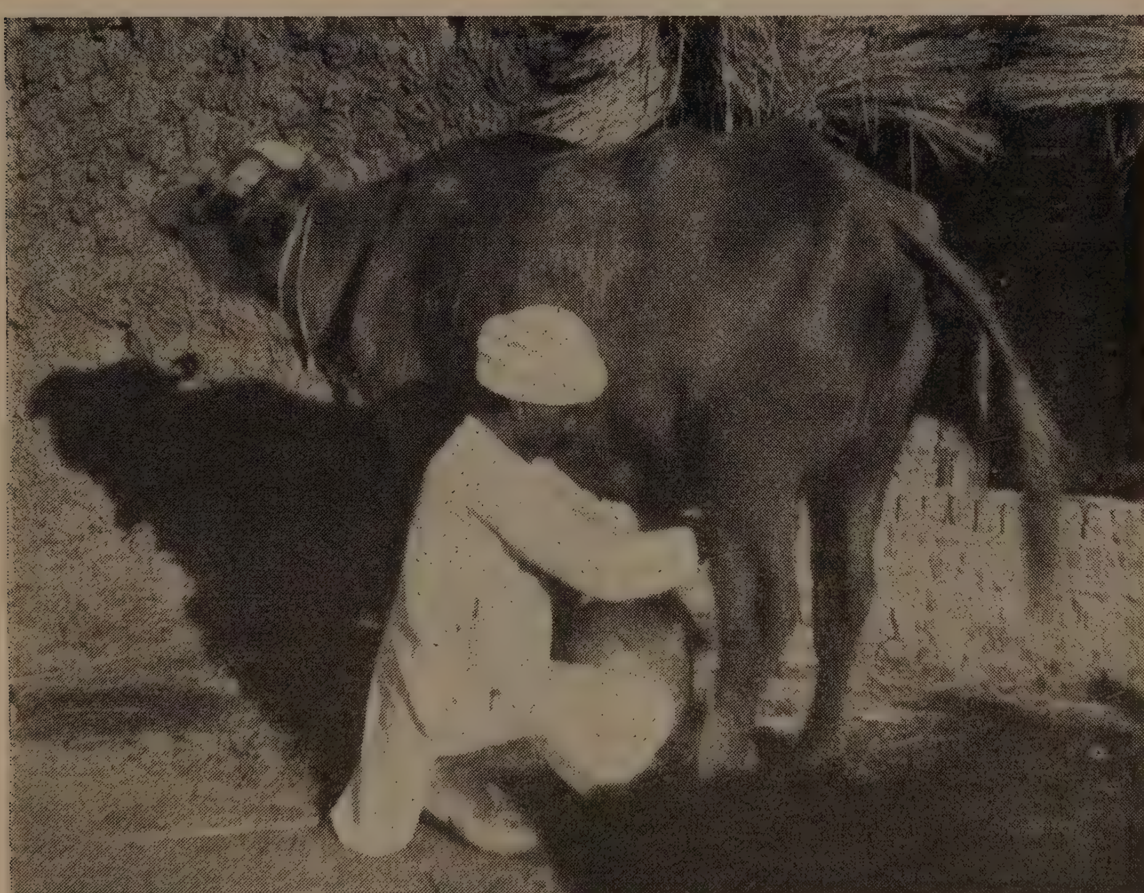


Plate 82.

Milking a Buffalo in the Open. Note dung drying on shed for fuel.

Arising from contamination during milking, handling and transport, coupled with high atmospheric temperatures during the hot months, the keeping quality of raw milk is short—not more than six hours in the summer.

On most places where milk is produced, the following essentials for its production are lacking:—

(1) An adequate supply of water.
(2) A hot water supply and proper equipment for washing and sterilizing utensils.
(3) Proper utensil storage to avoid recontamination of clean utensils.
(4) Utensils capable of being thoroughly cleaned and not otherwise affecting milk quality.
(5) A means of cooling milk and keeping it cold.

Cows and buffaloes are milked in the open, except on a few places which have larger herds, where milking is done in covered sheds. The cows and buffaloes are also fed in these sheds, which often have floors which are cracked and littered with dust and debris from dry fodder. Flies abound in the yards, shed and milk room. The open-air milking system is preferable to the general conditions of production in sheds, but even in the open, dust and flies are prevalent. Milkers' hands and udders did not appear to be washed, but due to the general shortage of water, even if these practices were adopted, contamination would only be increased, as the water would not be changed as often as necessary.

The milking utensils were generally of a kind most difficult to clean easily. A similar position applies with respect to the vessels used for milking, for conveying milk to the city and for retail distribution. Moreover, most vessels are without a cover; to prevent spillage in transit, the mouth is stuffed with straw or leaves. Dust and straw residues, flies, insects and other extraneous material float on the surface of the milk. On being transferred to the vendors' vessels it is often strained through muslin, which is used again and again after a washing which is such as to make it anything but sterile; it is often discoloured.

Even if utensils appeared superficially clean they were not properly sterilized by boiling water.

Except for conveying milk by horse cart or motor truck, the conventional milk can of other countries does not lend itself to wide use under the more common method of carrying milk by pack animal, head load or bicycle. Investigation is needed to evolve a suitable vessel for these typical Pakistani methods of transport. Similarly, owing to the acute scarcity of water in many villages, a means of sterilizing other than by water or steam would be desirable; research may indicate the practicability of sterilizing by heating directly over a fire.

The cooling of milk by means of water would be impracticable in the hot months, and in any case the inadequacy of supply for washing the milkers' hands, animals' udders and utensils quite obviously prevents water being used for the cooling of milk under the usual village conditions. It might be practicable to overcome this difficulty at villages where milk is produced for town consumption by providing a mechanical cooling unit of the type supplied in Queensland by the Butter Marketing Board, housed in a central place in the village, to which each producer would fetch his milk for cooling prior to bulking and despatch to the town.

(TO BE CONTINUED.)

Register of Merit for Dairy Cattle.

R. A. PAUL and S. E. PEGG, Division of Dairying.

A REGISTER of Merit for Dairy Cattle has been instituted in this State in order that a permanent record of superior producing strains of cattle will be available to all interested dairy farmers.

The register is divided into two parts—female and male. The female part is further subdivided into Intermediate, Lifetime and Elite sections according to the respective total production of cows in stipulated numbers of lactations. The male part of the register records bulls which have sired stipulated numbers of daughters entered in the female part of the register.

In recent years, emphasis on the improvement of dairy production through breeding has been placed on the sire and his selection through progeny recording. It must be remembered, however, that in respect of any individual the dam contributes as much to the constitution and productive ability as the sire. It is therefore necessary for considerable care to be exercised in the selection of superior females to mate with the best sires.

The practice in this State has always been to assess the superior female on the production record of one lactation. This has focussed attention on single superior performances, yet on occasions the single superior performance has been followed by several lactations in which the cow has produced at only average or below-average level.

In other countries it has been found that greater progress in increasing production through breeding has been made by assessing the value of a dairy cow on her lifetime production. Many cows have not come into prominence with an outstanding performance in an individual lactation, but, by regular yearly calvings and moderate productions, have been most profitable over the period they have been in the herds. The lifetime performance of these cows is the real measure of their worth, and the Register of Merit is designed to draw attention to such animals.

RULES.

The rules governing the Register of Merit, which were discussed with representatives of the dairy cattle breed societies before being finally adopted, are based on those operating in New South Wales and Western Australia. This action was taken to achieve uniformity throughout the Commonwealth. The desirability of such uniformity was reported to the Australian Animal Production Committee by the Technical Sub-Committee on Dairy Cattle after a meeeting in 1950, when it was suggested that the Register of Merit in use in New South Wales should be used as a pattern by the other States.

The rules are set out below:—

Female Register of Merit.

The Register will be divided into three sections, as follows:—

(*a*) Intermediate Register of Merit.

(*b*) Lifetime Register of Merit.

(*c*) Elite Register of Merit.

(a) Intermediate Register of Merit.

1. To qualify for entry, a cow recorded under the Pure Bred Cattle Production Recording Scheme or the Herd Production Improvement Scheme must have produced in three successive lactations, with not more than 18 months between consecutive calving dates, a total of at least 1,100 lb. of butterfat.

If a cow commences her first qualifying lactation at an age of less than 2 years 183 days, the figure will be reduced to 1,050 lb. of butterfat.

2. A cow must produce in each lactation at least 300 lb. of butterfat, except that in the case of a lactation commencing before the age of 2 years 183 days the minimum standard shall be 275 lb. butterfat.

(b) Lifetime Register of Merit.

1. To qualify for entry, a cow must produce a minimum of 2,240 lb. of butterfat in not more than eight and not less than four lactation periods.

(c) Elite Register of Merit.

1. To qualify for entry, a cow must produce a minimum of 3,600 lb. of butterfat in not more than 10 lactation periods.

General Rules to Cover the Register.

1. Production for each lactation shall be based on the first 273 days from commencement of recording.

2. The Register shall show—

(*a*) The name of the owner.

(*b*) The name and herd book number of the cow.

(*c*) The date of birth of the cow.

(*d*) The name and herd book number of the sire.

(*e*) The name and herd book number of the dam.

(*f*) The date of calving prior to the commencement of each qualifying lactation in the case of the Intermediate Register of Merit.

(*g*) The pounds of milk, butterfat percentage, pounds of butterfat and number of days for each lactation in the case of the Intermediate Register of Merit.

(*h*) In the case of the Lifetime and Elite Registers of Merit, the date of commencement of the first and last lactations, the total yield of milk and butterfat, the average test and the number of lactations.

3. A certificate giving the particulars as set out in (2) above will be issued free of charge on application.

4. All qualifying records produced under the Pure Bred Dairy Cattle Production Recording Scheme will be automatically accepted. For records produced under the Herd Production Improvement Scheme it will be necessary for the owner to make application for acceptance, and such application shall be accepted only if the cow is identifiable to the satisfaction of the Director of Dairying, and has been sired by a registered purebred bull or a bull eligible for such registration.

5. Records subsequent to the issue of a certificate shall be added on application to the Director of Dairying, Department of Agriculture and Stock, Brisbane.

Sires Register of Merit.

To qualify for entry a sire shall be represented by—

(1) Five daughters in the Intermediate Register of Merit; or

(2) Three daughters in the Lifetime Register of Merit; or

(3) Four daughters distributed in the Intermediate and Lifetime Registers of Merit—that is, two in the Intermediate plus two in the Lifetime Register of Merit, or three in the Intermediate and one in the Lifetime Register of Merit.

Entry to the Register of Merit is based on actual butterfat production. No corrections are made for age, except for the allowance referred to in the qualifications for entry to the Intermediate Register of Merit. Thus the possibility of an error being introduced through any correction factor being in itself incorrect is avoided.

QUALIFIED STOCK.

Table 1 sets out, according to breed, the number of cows which have qualified for entry into the Register as at 1st June, 1952. It indicates that the previous practice in this State of recording cows for one lactation period only, instead of over their lifetime, has resulted in only 73 cows and one bull being eligible for entry in the Register.

TABLE 1.

NUMERICAL AND BREED COMPOSITION OF THE FEMALE REGISTER.

Section.	Breed.					Total.
	A.I.S.	Ayrshire.	Friesian.	Guernsey.	Jersey.	
Intermediate . .	18	1	. .	1	40	60
Lifetime . .	5	. .	1	1	5	12
Elite	1	. .	. .	. .	. .	1

The examination of a large number of production records suggests that a considerable number of cows could have qualified for entry in the Register had they been recorded in successive lactations. The standards for entry into various parts of the Register have been chosen to ensure that only cows which have consistent production at a reasonably high level will qualify.

All animals which are included in the Register are shown in Tables 2-5, which have been compiled in alphabetical order according to breed and owner. Details of the outstanding cow and the outstanding sire are given hereunder.

The Outstanding Cow.

''Alfa Vale Model 2nd'' is the only cow in the Elite Register of Merit. She produced 170,087 lb. milk and 7,960 lb. butterfat in 12 lactations each of 273 days. Two of these lactations were extended to a period of 365 days and one to 330 days; with these extra periods included she produced 176,287 lb. milk and 8,275 lb. butterfat in 12 lactations.

As far as can be ascertained the total of the twelve 273 days lactations was a record performance for an Australian cow until it was recently beaten by a Victorian cow.

Plate 83.

"Alfa Vale Model 2nd," owned and bred by Mr. W. H. Thompson, "Alfa Vale," Nanango, is the only cow so far qualified for the Elite section of the Lifetime Register of Merit. Her production of 170,087 lb. milk and 7,960 lb. butterfat in 12 lactation periods each of 273 days was until recently an Australian record.

"Alfa Vale Model 2nd" was bred by Mr. W. H. Thompson, "Alfa Vale," Nanango, and was sired by "Reward of Fairfield," her dam being "Model of Alfa Vale," who was recorded once only for a production of 564 lb. butterfat in 273 days at the age of 15 years.

"Alfa Vale Model 2nd" has passed on her productive ability to her progeny, of whom the most famous is "Alfa Vale Pride 2nd," a bull that has been used with great success in the "Valera Stud" owned by Sullivan Bros., Pittsworth. In the 1950-51 Pure Bred Dairy Cattle Production Recording Report this sire had 38 daughters recorded for 51 lactations, with an actual average production of 330 lb. butterfat. Unfortunately, none of her daughters have sufficient lactation records to qualify for entry to the Register of Merit, but one, "Alfa Vale Model 19th," produced 541 lb. butterfat as a Junior 3-year-old and 587 lb. as a Mature cow; whilst another, "Alfa Vale Model 29th," as a Junior 3-year-old produced 691 lb. butterfat.

The Outstanding Sire.

"Reward of Fairfield" (1769 IMSHB) is the only bull to qualify for the Sires Register of Merit, and he is the outstanding prepotent sire of the A.I.S. breed in this State.

This bull was bred by Alexander Bros., "Fairfield," Kiama, N.S.W., and was owned by Mr. W. H. Thompson, "Alfa Vale," Nanango.

"Reward of Fairfield" is a son of "Fairy's Foch of Fairfield" (646 IMSHB) and "Favourite 2nd of Fairfield" (12 IHB of N.S.W.). "Fairy's Foch of Fairfield" has nine daughters with a mature equivalent average production of 429 lb. butterfat, and is by "Foch of Greyleigh," whose 23 daughters averaged 404 lb. butterfat (mature equivalent), whilst his dam is "Fairy of Fairfield," who produced 650 lb. butterfat as a mature cow.

"Favourite 2nd of Fairfield" is the progeny of "Fairfield of Fairfield" (2 IHB of N.S.W.) mated with his own daughter, "Favourite of Fairfield" (11 IHB of N.S.W.) "Fairfield of Fairfield" had four daughters recorded, with a maturity equivalent average production of 516 lb. butterfat.

Forty-four daughters of "Reward of Fairfield" have been recorded; their average production is 416 lb. butterfat, for which maturity equivalent is 535 lb. butterfat.

Plate 84.

"Reward of Fairfield" is the only bull to qualify for entry into the Sires Register of Merit. He was owned by Mr. W. H. Thompson, "Alfa Vale," Nanango, and has been the outstanding sire of the A.I.S. breed in this State.

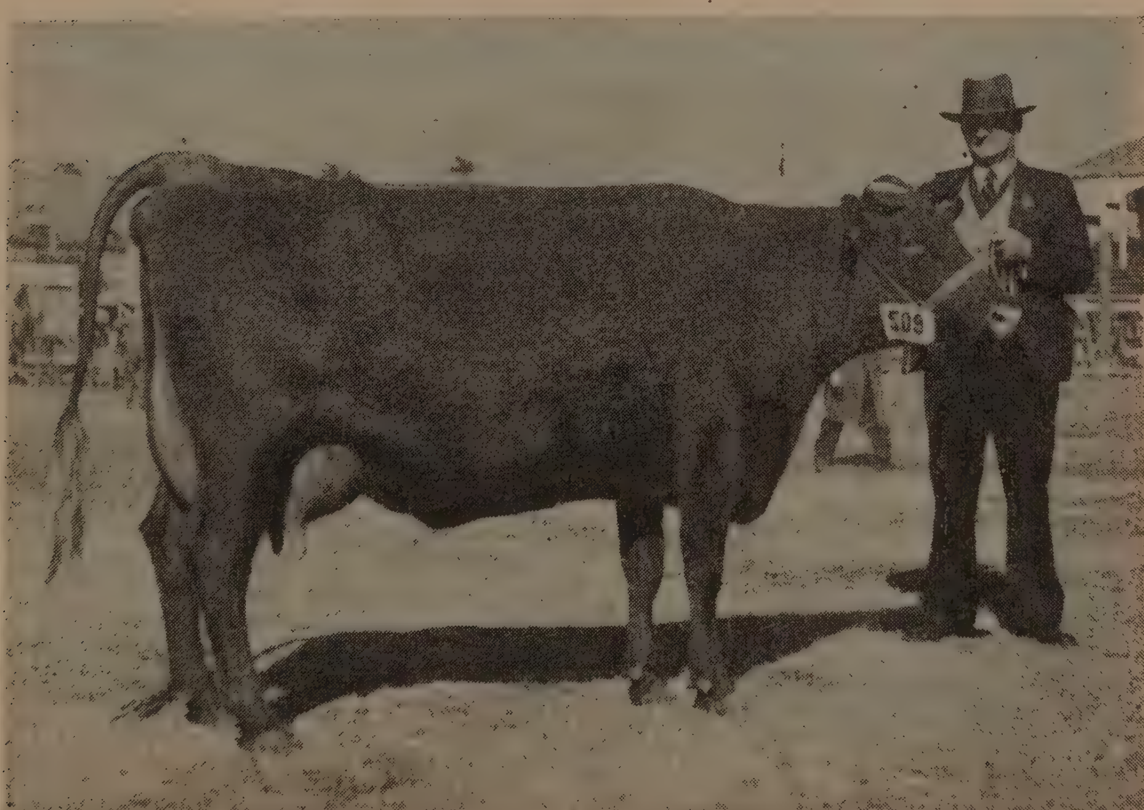


Plate 85.

"Sunnyside Honey 8th" has qualified for entry into the Lifetime Register of Merit with a production of 77,072 lb. milk and 2,999 lb. butterfat in seven lactation periods. She was bred and owned by Mr. P. Moore, "Sunnyside," Wooroolin.

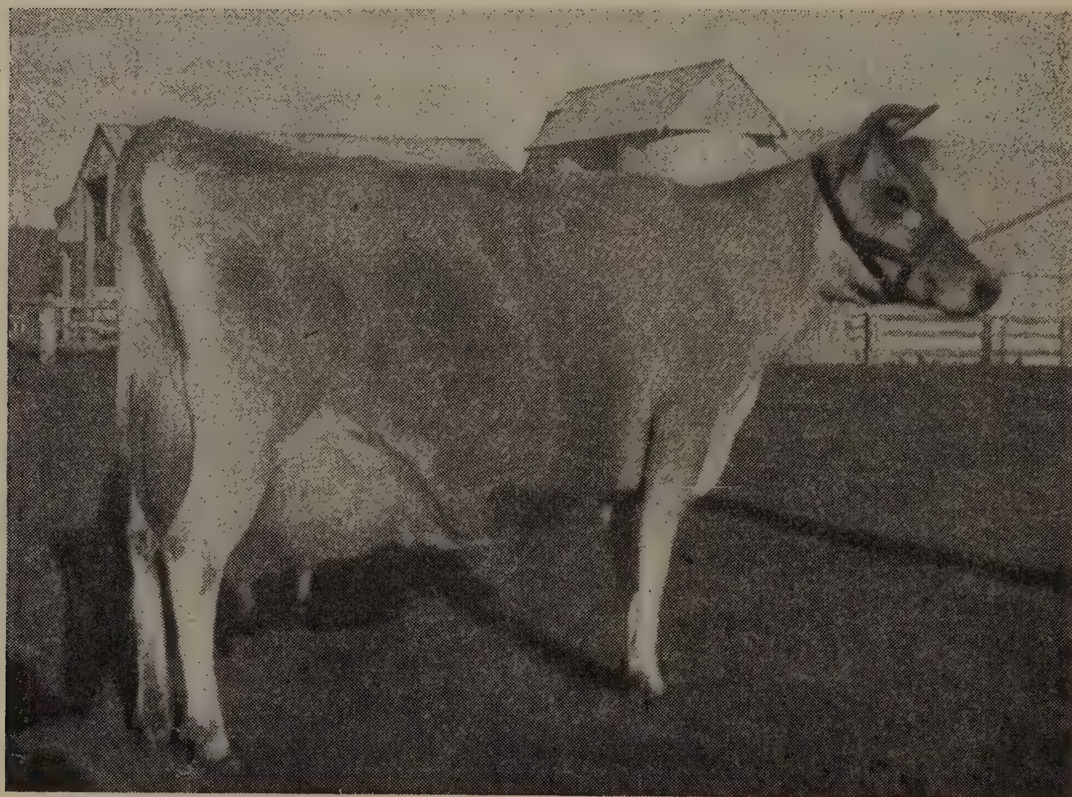


Plate 86.

"Trecarne Chimes 5th" was owned and bred by the late Mr. T. A. Petherick, "Trecarne," Lockyer. She qualified for entry into the Lifetime Register of Merit with a production of 54,172 lb. milk and 2.791 lb. butterfat in seven lactations.

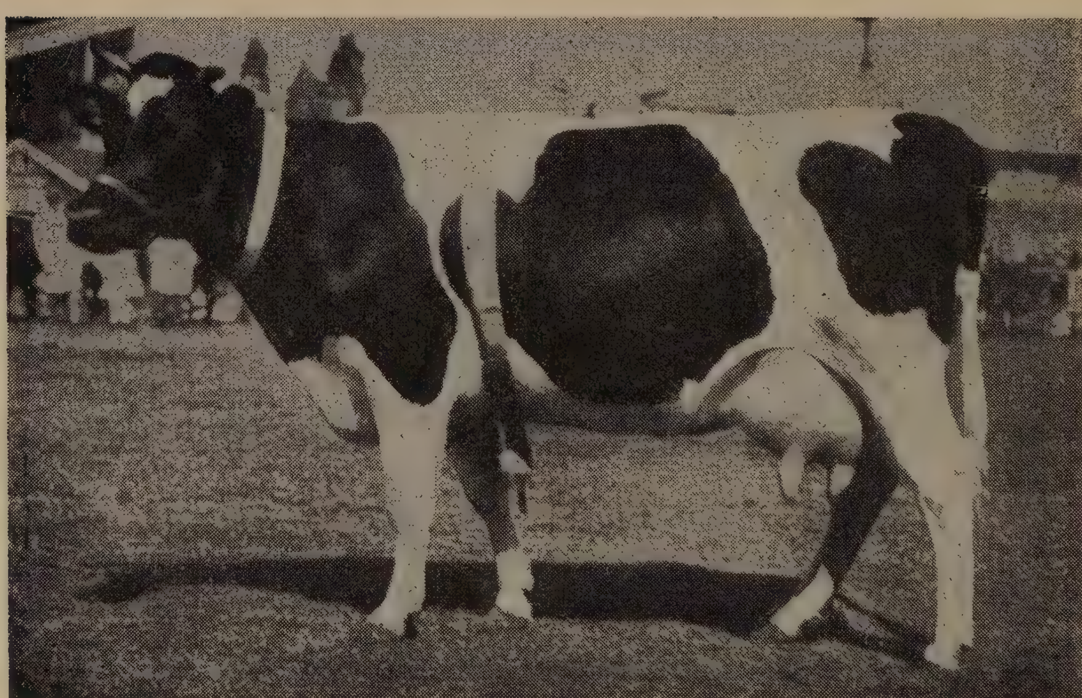


Plate 87.

"College Princess Pontiac" is the only Friesian to qualify for entry into any of the registers. She entered the Lifetime Register of Merit with a production of 75,864 lb. milk and 2,570 lb. butterfat in four lactations. She was bred by the Queensland Agricultural College and was owned by Hickey and Sons Pty. Ltd., "Glendalough," Wilston.

Plate 88.

"Laureldale Vida" is the only Guernsey cow in the Lifetime Register of Merit. She qualified for entry with a production of 48,871 lb. milk and 2,322 lb. butterfat in five lactations. "Laureldale Vida" was bred and is owned by Mr. W. A. Cooke, "Laureldale," Witta, Maleny.

Plate 89.

"Eleresley Jonquil," owned by Stimpsons Pty. Ltd., "Eleresley," Loganlea, is the only Ayrshire cow to qualify for entry into any of the registers. She is in the Intermediate Register of Merit with a production of 29,815 lb. milk and 1,314 lb. butterfat.

TABLE 2.

INTERMEDIATE REGISTER OF MERIT.

Name of Cow. (*Name of Sire*).	Herd Book Number.	Date of Beginning of Record.	Age.	Production Records. Milk.	Production Records. Average Test.	Production Records. Total Butterfat.
			yrs. mths.	Lb.	%	Lb.
AUSTRALIAN ILLAWARRA SHORTHORN.						
C. W. Black, "Ventnor," Kumbia.						
Kyabram Mab	21076	23–3–39	3 10	11,765	4·5	529
(*Ledger of Greyleigh*)	2437	15–4–40	4 11	16,962	4·3	733
	..	3–7–41	6 1	13,448	3·8	511
W. D. Davis, "Wamba," Chinchilla.						
Bunya View Thelma's Pride	42370	25–10–46	3 3	10,072	4·0	404
(*Bingleigh Royal*)	6582	12–11–47	4 4	8,448	4·4	370
	..	18–11–48	5 4	10,583	4·2	448
J. F. Evans, "Evansvale," Malanda.						
Evansvale Carey	24921	30–1–40	5 3	9,689	4·1	397
(*Malanda of Glenore*)	1323	9–1–41	6 2	8,829	4·1	360
	..	29–11–41	7 1	11,236	4·7	526
J. H. Fogg, "Aelkcor," Toogoolawah.						
Cedar Valley Rosette	56446	17–7–48	2 0	8,613	4·0	348
(*Kyabram Masterpiece*)	7094	21–9–49	3 2	10,066	4·0	406
	..	7–11–50	4 4	9,145	3·9	357
M. C. Lester, "St. Andrews," Glengallan, Warwick.						
St. Andrews Violet	53482	17–1–49	3 5	10,682	4·4	471
(*Bingleigh Premier*)	7784	19–1–50	4 4	10,026	4·5	452
	..	17–1–51	5 5	10,125	4·4	442
St. Andrews Olive	Vol. 13	10–7–49	1 8	8,749	4·2	373
(*Tabbagong Victory*)	8729	14–7–50	2 8	10,287	4·2	430
		5–7–51	[illegible]	[illegible]	[illegible]	[illegible]

(*Parkview Limerick*)	5110	4–3–48	2 11	12,961	3·5	456
	..	4–3–49	3 11	11,728	4·0	465
Navillus Showgirl 4th	45670	30–7–46	3 11	14,715	3·5	516
(*Greyleigh Eros*)	2193	5–2–48	5 5	15,116	3·3	501
	..	15–2–49	6 6	19,322	3·7	709
Rosemount Empress 9th	14815	4–11–30	4 1	12,620	4·0	509
(*Bright Star of Cosy Camp*)	IMSHB	14–10–31	5 0	13,257	3·9	522
	416 IMSHB	19–2–33	6 4	12,854	4·1	524
	W. Soley, "Merravale," Malanda.					
Merravale Model 4th	31921	5–11–39	4 11	10,455	3·2	336
(*Greyleigh Honorarium*)	321	3–12–40	6 0	11,432	3·6	416
	..	17–1–42	7 2	12,517	3·2	398
Merravale Ruby 12th	31925	24–2–40	2 3	10,568	3·2	343
(*Greyleigh Honorarium*)	321	16–2–41	3 3	10,246	3·6	370
	..	3–1–42	4 2	12,413	3·5	437
Merravale Tulip 4th	31929	13–11–39	7 7	13,803	3·3	457
(*Greyleigh Honorarium*)	321	8–1–41	8 9	13,944	3·7	512
	..	17–2–42	9 11	13,855	4·4	616
	D. Sullivan, "Bantry," Pittsworth.					
Bantry Model	48772	3–3–46	1 10	6,904	4·2	292
(*Alfa Vale Pride 2nd*)	5441	11–3–47	2 10	10,140	3·9	393
	..	2–2–48	3 9	9,239	4·3	398
	W. H. Thompson, "Alfa Vale," Nanango.					
Alfa Vale Gem 10th	18738	11–6–38	1 7	10,853	4·1	440
(*Reward of Fairfield*)	1769	18–6–39	2 7	14,246	3·8	541
	IMSHB	3–6–40	3 7	14,689	3·6	524
Alfa Vale Model 4th	8654	24–3–39	6 9	14,275	4·2	598
(*Reward of Fairfield*)	1769	4–4–40	7 9	15,718	4·3	679
	IMSHB	3–7–41	9 0	16,056	4·7	753
Alfa Vale Model 11th	18748	18–3–38	2 3	11,545	4·7	538
(*Reward of Fairfield*)	1769	27–3–39	3 3	12,983	4·6	600
	IMSHB	28–4–40	4 4	14,897	4·3	635

TABLE 2.—*continued.*

INTERMEDIATE REGISTER OF MERIT—*continued.*

Name of Cow. (*Name of Sire*).	Herd Book Number.	Date of Beginning of Record.	Age.	Production Records. Milk.	Average Test.	Total Butterfat.
			yrs. mths.	Lb.	%	Lb.
AUSTRALIAN ILLAWARRA SHORTHORN—*continued.*						
W. H. Thompson, "Alfa Vale," Nanango—*continued.*						
Alfa Vale Pansy	23361	3–6–40	2 8	12,966	4·4	569
(*Reward of Fairfield*)	1769	26–8–41	3 11	14,889	4·6	687
	IMSHB	2–8–42	4 11	16,871	4·3	724
Alfa Vale Star 2nd	6295	8–8–33	2 1	10,923	4·0	437
(*Reward of Fairfield*)	1769	3–8–34	3 1	13,604	4·5	618
	IMSHB	23–7–35	4 1	15,010	4·3	646
Alfa Vale Model 16th	28764	6–7–41	1 10	9,569	4·9	466
(*Penrhos Pansy's Pride*)	4265	20–6–42	2 10	12,784	5·0	640
	..	10–7–43	3 10	12,687	4·8	606
AYRSHIRE.						
Stimpson's Pty. Ltd., "Elleresley," Loganlea.						
Eleresley Jonquil	40713	14–5–48	4 11	8,124	4·4	358
(*Eleresley Major 2nd*)	11528	30–7–49	6 1	10,745	4·2	448
	..	12–9–50	7 3	10,946	4·6	508
GUERNSEY.						
A. Ruge and Sons, "Woowoonga," Woowoonga.						
Willowbrae Daffodil	20526	3–5–49	2 3	7,157	4·7	336
(*Linwood Pharos*)	5993	4–5–50	3 3	7,956	5·0	399
	..	27–4–51	4 3	9,421	4·7	439
JERSEY.						
H. T. W. Barker, "Parkview," Oakey.						
Brookland Merry Melrose	36380	26–5–45	2 5	6,231	4·7	294
(*Bulby Maria's Keepsake*)	13784	1–7–46	3 6	6,581	4·9	321

	..	17–9–49	4 0	6,574	5·2	345
W. Bishop, "Gem," Kenmore.						
Gem Iris	21680	17–7–39	2 11	7,076	5·4	379
(*Lacey's Volunteer of Ardroy*)	8337	1–9–40	4 0	9,848	5·1	505
	..	2–10–41	5 1	8,836	5·5	490
R. J. Browne, "Hill 60," Yangan.						
Balwyn Ginger Lass	37315	28–8–45	6 6	6,909	5·4	375
(*Oxford Darby*)	7056	29–9–46	7 7	7,296	5·7	415
	..	6–9–47	8 6	5,910	5·5	328
Minidong Maid	42488	14–8–47	1 8	6,241	5·2	327
(*Balwyn Fancy's Baron*)	14161	30–9–48	2 9	7,088	5·2	371
	..	6–1–50	4 0	7,059	5·7	403
Nairfale Idol's Delight	42733	16–8–47	2 1	5,710	5·4	310
(*Nairfale Golden Recorder*)	19872	14–7–48	2 11	6,428	5·3	341
	JSBA	1–9–49	4 0	7,179	5·7	412
Nairfale Lady Laura	42736	30–7–45	2 5	5,334	5·3	283
(*Nairfale Noble Count*)	10939	4–8–46	3 5	6,888	5·3	367
	JSBA	10–7–47	4 5	7,781	5·3	415
Nairfale Likeness	42730	5–8–47	3 0	8,685	4·9	423
(*Nairfale Golden Recorder*)	19872	15–7–48	3 11	8,849	5·2	459
	JSBA	14–7–49	4 11	9,975	4·6	462
Nairfale Neat Neta	42738	25–2–46	2 2	7,278	6·0	435
(*Nairfale Count's Paymaster*)	19870	7–1–47	3 1	6,929	5·6	386
	JSBA	1–12–47	3 11	6,803	5·2	351
Nairfale Noble's Esteem	16323	6–12–48	2 0	5,714	5·8	333
(*Nairfale Pride's Noble*)	17828	6–11–49	2 11	7,097	6·0	432
	JSBA	1–10–50	3 10	8,032	6·0	480
Nairfale Princess Beth	7979	18–11–47	4 10	6,823	4·9	334
	JSBA	16–12–48	5 11	8,593	5·3	460
(*Nairfale Noble Count*)	10939	6–7–50	6 6	9,887	5·1	505
	JSBA					
Nairfale Trinket	42727	16–7–48	3 10	6,943	5·3	371
(*Nairfale Count's Prominence*)	19871	12–9–49	5 0	6,860	5·4	374
	JSBA	18–7–50	5 11	7,090	5·3	373

TABLE 2.—*continued.*

INTERMEDIATE REGISTER OF MERIT—*continued.*

Name of Cow. (*Name of Sire*).	Herd Book Number.	Date of Beginning of Record.	Age.	Production Records. Milk.	Production Records. Average Test.	Production Records. Total Butterfat.
			yrs. mths.	Lb.	%	Lb.
JERSEY—*continued.*						
E. Burton and Sons, "Oxford," Wanora.						
Oxford Aster	8505	10–7–30	1 10	5,827	5·6	324
(*Trinity Ambassador*)	2834	25–7–31	2 11	6,536	6·3	412
	..	24–7–32	3 11	7,348	6·5	481
Oxford Aster Daisy	11806	7–7–32	1 10	5,801	6·7	387
(*Trinity Ambassador*)	2834	4–8–33	2 11	7,569	6·7	510
	..	12–8–34	3 11	8,277	6·2	516
H. Cochrane, "Fauvic," Kin Kin.						
Fauvic Recoil	36010	29–4–47	5 10	6,893	6·1	422
(*Shepstone Gallant Lad*)	18060	24–4–48	6 9	5,463	6·0	328
	..	2–5–49	7 10	7,886	5·7	446
W. S. Conochie, "Brookland," Sherwood.						
Brookland Cream Flake	39224	3–6–45	2 1	7,000	5·7	397
(*Englorie Cunning Victor*)	15559	31–10–46	3 5	8,342	5·6	466
	JSBA	7–11–47	4 6	6,428	6·6	428
Brookland Merry Primula	40254	26–5–45	2 5	6,231	4·7	294
(*Bulby Maria's Keepsake*)	13784	1–7–46	3 6	6,581	4·9	321
	..	11–8–47	4 8	8,211	6·0	495
Brookland Merry Prudence	40255	13–10–46	2 0	6,708	5·1	346
(*Bulby Maria's Keepsake*)	13784	4–11–47	3 0	6,670	5·9	395
	..	12–12–48	4 2	7,292	5·5	404
F. P. Fowler and Sons, "Glenview," Coalstoun Lakes.						
Glenview Hawthorne	19638	22–8–37	3 7	8,682	5·3	461
(*Trinity Governor's Hope*)	5730	13–7–38	4 5	9,961	5·3	531
	..	28–7–39	5 6	10,515	4·5	469

(*Banyule Silvermine Oxford*)	11462	7–5–47	4 4	3,832	[illegible]	[illegible]
	..	26–7–48	5 7	8,025	4·8	384
C. Huey, "Ashview," Sabine.						
Ashview Lady 2nd	40892	18–7–47	4 9	6,657	6·1	409
(*Trecarne Victor 4th*)	11492	3–9–48	5 11	7,164	5·7	408
	..	31–8–49	6 11	6,991	5·7	400
Ashview Lady 3rd	39377	28–5–47	3 9	6,885	5·9	410
(*Trecarne Victor 4th*)	11492	2–7–48	4 10	7,840	5·9	462
	..	17–7–49	5 11	5,369	5·7	309
P. Kerlin, "Glenrandle," Killarney.						
Glenrandle Handsome Lady	38345	13–8–44	2 0	6,410	5·7	369
(*Bellgarth Stylish*)	10878	22–12–45	3 5	6,915	5·5	380
	..	4–3–47	4 7	6,208	6·0	372
Glenrandle Lottie	45462	3–6–47	2 4	6,048	5·7	348
(*Bellgarth Glory King 2nd*)	13573	13–7–48	3 6	6,265	5·6	352
	..	24–6–49	4 5	7,815	5·2	414
Glenrandle Lucy	41026	13–8–45	1 11	6,819	5·3	360
(*Bellgarth Glory King*)	12971	10–9–46	3 0	7,320	5·3	391
	..	1–11–47	4 2	7,216	5·0	365
Glenrandle Luna	39202	2–7–46	3 0	5,865	5·6	332
(*Bellgarth Stylish*)	10878	16–6–47	4 0	6,334	5·9	372
	..	9–8–48	5 1	6,996	5·7	397
Glenrandle Nisa 2nd	38341	28–8–44	2 1	6,937	5·1	354
(*Bellgarth Stylish*)	10878	18–10–45	3 3	7,663	5·3	405
	..	22–11–46	4 4	7,187	5·3	382
J. S. McCarthy, "Glen Erin," Greenmount.						
Ellerdale Watfern Berenice	21424 JSBA	31–10–48	1 11	5,721	6·1	351
(*Ellerdale Watfern Gamboge*)	16323	27–9–49	2 10	6,326	6·0	385
	JSBA	27–9–50	3 10	6,657	6·1	405
Lermont Model 2nd	40421	23–4–47	2 5	5,165	6·4	330
(*Trinity Noble Effort*)	13323	2–5–48	3 6	5,373	6·3	337
	..	22–5–49	4 6	6,599	6·3	419

TABLE 2—*continued.*

INTERMEDIATE REGISTER OF MERIT—*continued.*

Name of Cow. (*Name of Sire*).	Herd Book Number.	Date of Beginning of Record.	Age.	Production Records. Milk.	Average Test.	Total Butterfat.
			yrs. mths.	Lb.	%	Lb.
JERSEY—*continued.*						
T. A. Petherick, "Trecarne," Lockyer.						
Trecarne Rosella 8th	23346	3–3–39	3 6	5,910	5·4	320
(*Trinity Some Officer*)	6798	20–3–40	4 7	6,732	5·9	396
	..	28–7–41	5 11	7,325	5·6	413
F. Porter, "Westwood," Conondale.						
Westwood Goldilocks	31604	3–8–45	6 8	9,598	6·2	593
(*Hunstrate Emperor's Volunteer (imp.)*)	6457	17–8–46	7 9	8,307	6·0	496
	..	15–8–47	8 9	10,679	5·4	575
J. Schull, "Lermont," Oakey.						
Lermont Kitty	24238	20–8–38	2 0	7,439	5·0	375
(*Woodside Golden Volunteer*)	6366	20–7–39	2 11	7,956	5·5	437
	..	24–7–40	3 11	9,670	4·8	467
A. L. Semgreen, "Tecoma," Coolabunia.						
Tecoma Fairy Dove	41493	3–3–48	4 6	6,626	4·9	326
(*Trinity Golden Royal*)	10760	9–5–49	5 8	6,504	6·1	395
	..	10–5–50	6 8	8,461	4·8	407
Tecoma Golden Darling	40661	25–2–48	5 6	5,797	6·2	359
(*Trinity Golden Royal*)	10760	6–5–49	6 9	6,504	6·1	395
	..	3–8–50	8 0	10,464	5·7	601

T. Sinnamon and Sons, "Trinity," Goodna.						
Trinity Crowning Poppy	34621	8–8–46	5 0	7,501	4·6	342
(*Trinity Crowning Effort*)	12311	23–7–47	6 0	9,378	4·5	424
	..	10–8–48	7 0	9,375	4·5	422
Trinity Graceful Lady	34638	8–8–44	2 0	7,071	4·8	342
(*Trinity Crowning Effort*)	12311	27–7–45	3 0	8,897	4·9	433
	..	1–8–46	4 0	9,202	4·9	454
Trinity Princess Rose	34644	21–7–44	1 11	5,804	5·4	312
(*Trinity Lily's Lad*)	12313	26–7–45	2 0	6,641	5·5	368
	..	2–8–46	3 0	9,105	5·7	459
J. Wilton, "Romsey," Killarney.						
Romsey Blossom	32277	2–8–45	6 1	7,948	5·0	394
(*Oxford Dainty Peer*)	10328	12–8–46	7 1	7,275	5·1	375
	..	15–10–47	8 3	7,148	5·4	385

TABLE 3.

LIFETIME REGISTER OF MERIT. (2,240 lb. butterfat minimum.)

Name of Cow.	Herd Book Number.	Age at Start of Recording.	Age at Commencement of Last Test.	Number of Records.	Total Milk.	Average Test.	Total Butterfat.	Name of Sire.	Herd Book Number of Sire.
		Yrs. Mths.	Yrs. Mths.		Lb.	%	Lb.		
AUSTRALIAN ILLAWARRA SHORTHORN.									
W. Henschell, "Yarranvale," Yarranlea.									
Trevor Hill Bonnie ..	54278	2 0	6 4	5	67,343	4·3	2,890	Trevor Hill Bosca ..	5351
P. Moore, "Sunnyside," Wooroolin West.									
Sunnyside Honey 8th ..	14329	2 8	10 4	7	77,072	3·9	2,999	Bruce of Avonel ..	2916 AMSHB
C. O'Sullivan, "Navillus," Greenmount.									
Navillus Charm 17th ..	45661	3 0	7 10	6	70,716	4·0	2,859	Greyleigh Eros ..	2193
W. Thompson, "Alfa Vale," Nanango.									
Alfa Vale Eveline	6288	2 5	8 1	5	70,290	4·4	3,123	Reward of Fairfield ..	1769 IMSHB
Alfa Vale Gentle 2nd ..	8641	2 6	9 4	5	58,373	4·4	2,611	Reward of Farifield ..	1769 IMSHB
FRIESIAN.									
Hickey and Sons Pty. Ltd., "Glendalough," Wilston.									
College Princess Pontiac ..	1839	3 5	9 1	4	75,864	3·4	2,570	Pabst Pontiac Blue Star (imp.)	254359 AHFHB
GUERNSEY.									
W. A. K. Cooke, "Laureldale," Witta, Maleny.									
Laureldale Vida	10754	2 8	8 2	5	48,871	4·7	2,322	Minnamurra Topsy's Sequel 2nd	5095
JERSEY.									
W. S. Conochie, "Brookland," Sherwood.									
Brookland Cunning Drop ..	35283	3 0	7 7	5	47,993	5·4	2,599	Englorie Cunning Victor	15559 JSBA
T. A. Petherick, "Trecarne," Lockyer.									
Tecarne Chimes 5th ..	31257	2 1	8 1	7	54,172	5·1	2,791	Jerseylea Golden Duke	13831 JSBA
Trecarne Dairymaid ..	22305	2 11	9 0	6	47,600	5·8	2,764	Trinity Some Officer ..	6798
Trecarne Jersey Queen 2nd	22304	3 1	10 1	7	52,134	5·6	2,913	Trinity Some Officer ..	6798
J. Wilton, "Romsey," Killarney.									

TABLE 4.

ELITE REGISTER OF MERIT.

(3,600 lb. butterfat minimum.)

Name of Cow.	Herd Book Number.	Age at Start of Recording.	Age at Commencement of Last Test.	Number of Records.	Total Milk.	Average Test.	Total Butterfat.	Name of Sire.	Herd Book Number of Sire.
		Yrs. Mths.	Yrs. Mths.		Lb.	%	Lb.		
AUSTRALIAN ILLAWARRA SHORTHORN.									
W. H. Thompson, "Alfa Vale," Nanango.									
Alfa Vale Model 2nd ..	741	2 0	13 10	12	170,087	4·7	7,960	Reward of Fairfield ..	1769 IMSHB

TABLE 5.

SIRES REGISTER OF MERIT.

Name of Sire (Breed).	Herd Book Number.	Intermediate Register of Merit.		Lifetime Register of Merit.		Total Daughters in Register of Merit.			Total Daughters Recorded.		
		Number of Daughters.	Average Butterfat.	Number of Daughters.	Average Butterfat.	Number of Daughters.	Lactations.	Average Butterfat.	Number of Daughters.	Daughters' Total Lactations.	Recorded Average Butterfat.
			Lb.		Lb.			Lb.			Lb.
W. H. Thompson, "Alfa Vale," Nanango.											
Reward of Fairfield (A.I.S.)..	1769 IMSHB	5	599	3	622	8	37	613	44	89	461

The Maintenance of Phage-Free Cheese Starter Cultures.

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CHEESE STARTERS.

THE first cheese starters that were used were derived from naturally-soured milk. Such starters must have contained a very great variety of organisms. No facilities existed for separating the clean from the undesirable acid-producing organisms, and as a result of the very mixed bacterial flora, it was inevitable that many undesirable fermentations resulted. When it became possible to segregate and study bacterial organisms, selections were made of those isolated from the old starters. This isolation and selection has continued and has provided the starter strains that are now available for cheesemaking.

All these starter strains are lactic streptococci. In some of the mixed commercial cultures for cheddar cheese manufacture, other bacterial species may be included (for example, flavour and aroma producing types), but these can be ignored here and the discussion confined solely to acid-producing organisms, acid production being the main purpose of cheese starters.

Description of Starter Organisms.

A streptococcus is a bacterial organism which exists as a round or elliptical cell, approximately 1 micron or 1/25,000 inch in diameter, the cells occurring in chains of varying length so that they somewhat resemble strings of beads. Sometimes the chains may be very long, sometimes only two or four cells in length.

The microscopic appearance of two streptococcal species is shown in Plate 90.

The length of the chains is usually characteristic of the strain but may be modified by a number of factors, the chief of which is the temperature of growth. Under standard conditions, however, the length of the chain is constant enough to be a useful guide in the differentiation of strains.

Most of the single strain cultures distributed by the Dairy Research Laboratory are strains of *Streptococcus cremoris.* Others belong to *Streptococcus lactis,* but because strains of lactis are more susceptible to bacteriophage attack, strains of cremoris are preferred.

The main differences between these two streptococcal species are:—

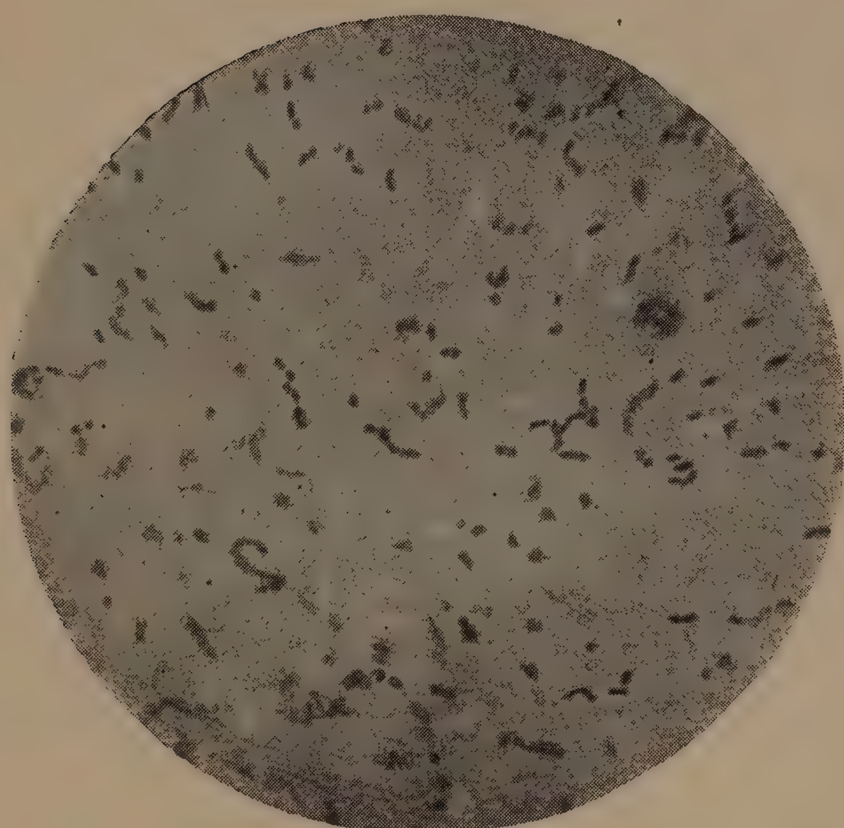
Streptococcus cremoris strains form characteristic long chains in milk and they fail to grow at 104°F. Bacteriophage races attacking these strains are generally specific. Strains HP, R1, Q4, YP7, D9, KH, S2, TR, UD4, S1, C1, C3 and C12 belong to *Streptococcus cremoris.*

Streptococcus lactis strains are predominantly arranged in pairs or short chains in milk, grow much more rapidly than strains of cremoris at temperatures above 95°F. and will grow at 104°F. They are attacked by a variety of phages and one phage race often attacks several strains of lactis. Strains ML3, C2, C5, C7, C8 and C10 are *Streptococcus lactis.* Cutures GB and ML2, which are not used now in Queensland factories, are also *Streptococcus lactis.*

Incubation of Starters.

Starter cultures are greatly affected by temperature variation. Their best temperature of growth is between 70° and 80°F. While they will grow faster at slightly higher temperatures, it is considered that their vitality may be impaired as a result.

a.



b.

Plate 90.

Photomicrographs of Streptococcus cremoris (top) and Streptococcus lactis (bottom). Note the typical long chains of the former and the predominant pairs and short chains of the latter.

In the maintenance of starter cultures in Queensland factories efforts have to be made to keep cultures at temperatures within these limits. If the temperatures vary at all from the recommended range, it is better that they vary below, rather than above, this range. Where no facilities exist for maintaining constant temperatures during winter, starters may be set at the uppermost limit of their optimum range,

say 80°F. This will ensure that when nights are cold cultures will remain warm for a sufficient time to allow their clotting. In fact, this commonly occurs in many cheese factories and is in no way deleterious to the starter, provided that the temperature is not maintained higher than 80°F. for any great length of time.

As a rule, special precautions have to be taken with mother cultures since their smaller bulk predisposes them to greater temperature fluctuations. With them some form of temperature control is necessary when air temperatures are well outside the optimum range. Some temperature control can be achieved by placing them in an enclosed bulk starter cabinet if such is available. If not, some other means of temperature control is necessary. This control can be achieved by means of a simple, easily constructed incubator, consisting of a metal container insulated on the lid and four sides. During winter a small spirit-lamp can be placed underneath, with sufficient baffling to give just the right temperature. In summer, a small quantity of ice placed inside will usually be sufficient to satisfactorily reduce the temperature.

Starter Distribution.

In Queensland all single strain starters are distributed to factories from the Dairy Research Laboratory at Toowoomba. Cultures are forwarded in screw-capped bottles in chalk-litmus-milk. The chalk is quite effective in neutralising excess acidity and thus enables the culture to remain viable for a period of at least a week. The litmus is merely an indicator of starter activity, a pink layer at the top of a culture which has been standing for several hours indicating an active culture. Cultures which are completely white or completely pink and remain so on standing are usually not viable.

In neutralising excess acidity, the chalk liberates large quantities of gas; whereas excess gas in a plain milk culture is undesirable, it is not detrimental in this instance.

Contamination of Starters.

Starter cultures in cheese factories may become contaminated either with other micro-organisms or with bacteriophage.

As better methods of starter propagation are adopted, the number of contaminated cultures in factories is becoming less and less, but there are still cases of contamination occurring from time to time.

All contamination from other micro-organisms must be classed as undesirable, but contamination by coliforms or yeasts must be considered particularly so, since these two organisms give rise to objectionable flavours and gas. Yeast is favoured by the highly acid conditions of the culture and will continue to grow in a clotted culture. Coliforms, on the other hand, tend to be inhibited by the acid conditions, but will grow sufficiently during the early stages of starter development to reach large numbers.

The best way to check for contamination is to submit the starter culture for regular bacteriological examinations. Departmental field officers will often be able to perform the necessary examinations during factory visits. If not, a sample of the mother culture can be taken in a sterilized bottle and forwarded to the Dairy Research Laboratory for examination. Care is required in the taking of the sample, since both bottle and closure must be sterilized and the bottle closed without allowing contamination.

BACTERIOPHAGE.

For many years the sudden failures of cheese starters have caused much concern amongst cheese makers. For no apparent reason the starter would occasionally cease to make acid in the cheese vat, the cessation in acid production usually lasting several hours. On other occasions the starter culture would fail to clot. These failures, occurring as they did without warning and without explanation, were a constant hazard. The explanation came as a result of research work in New Zealand, where it was shown that such starter failures were most commonly the result of the starter being contaminated with bacteriophage.

Bacteriophage is a bacterial virus. This means that it is similar to the viruses which cause disease in man and animals but that it affects bacterial cells. Thus a starter culture infected with bacteriophage may be said to be diseased.

The particles of bacteriophage are exceedingly small and can only be seen with the aid of the electron microscope. In Plate 91 are shown four electron microscope photographs of a strain of streptococcus attacked by bacteriophage. The magnification used is approximately 15,000 diameters. The bacteriophage particles can be seen to have a "tadpole" appearance with a distinct head and tail. Their size compared with that of the host streptococcal cells can be appreciated.

Bacteriophage particles, because of their small size, will pass through bacterial filters. These filters are made with pores of such a size that the bacterial cells are retained on the filter while the bacteriophage particles pass through into the filtrate. Such cell-free filtrates are important in the study of bacteriophage.

The ultimate source of bacteriophages is unknown. They are found to occur wherever strains of their host bacteria are cultivated regularly. Thus bacterioghages attacking *Streptococcus lactis* and *Streptococcus cremoris* are found in the environment of any cheese factory, particularly in whey. It is probable also that they could be found on some dairy farms.

Bacteriophage Growth.

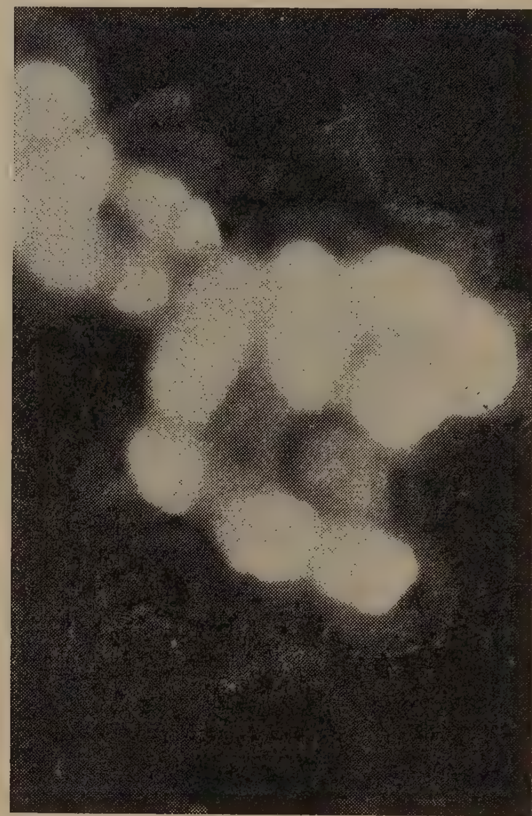
When phage particles gain access to a susceptible starter culture, they attack the bacterial cells and cause their disintegration.

In the process of destroying the cells of the culture, the number of phage particles increases until after a few hours almost all the cells are destroyed and the number of phage particles present becomes very great, reaching about 10,000,000,000 (expressed 10^{10}) per millilitre. This number of phage particles per millilitre is called the titre of the phage.

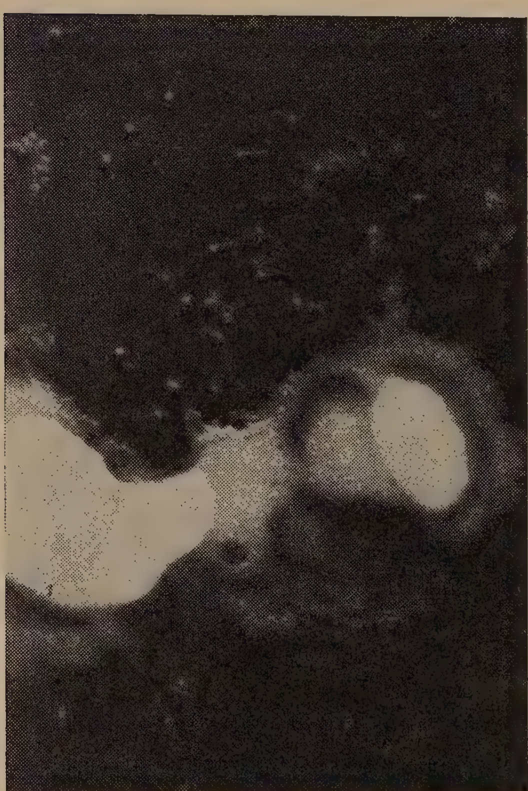
This destruction of bacterial cells and resultant increase in the titre of a phage takes place very quickly. It has been found that if a starter culture, freshly set up, is inoculated with even small quantities of bacteriophage, almost all the starter bacteria are destroyed in 3-4 hours.

In Plate 92 is shown a photograph of a bacterial plate which has been smeared with a cheese starter culture containing bacteriophage. It will be seen that the phage has produced a large number of small cleared areas where it has lysed the starter cells. Such cleared areas are termed plaques.

a.



b.



c.

d.

Plate 91.

Streptococcus lactis in the Presence of Bacteriophage. a and b, streptocci cells in association with bacteriophage particles; c, two cells in the process of disintegration; d, mass of material remaining from disintegrated cells and a chain of five sound cells.

(*Photographs* (*magnification* 15,000 *diameters*) *reproduced by kind permission of Dr. C. E. Parmslee, Iowa State College, U.S.A.*).

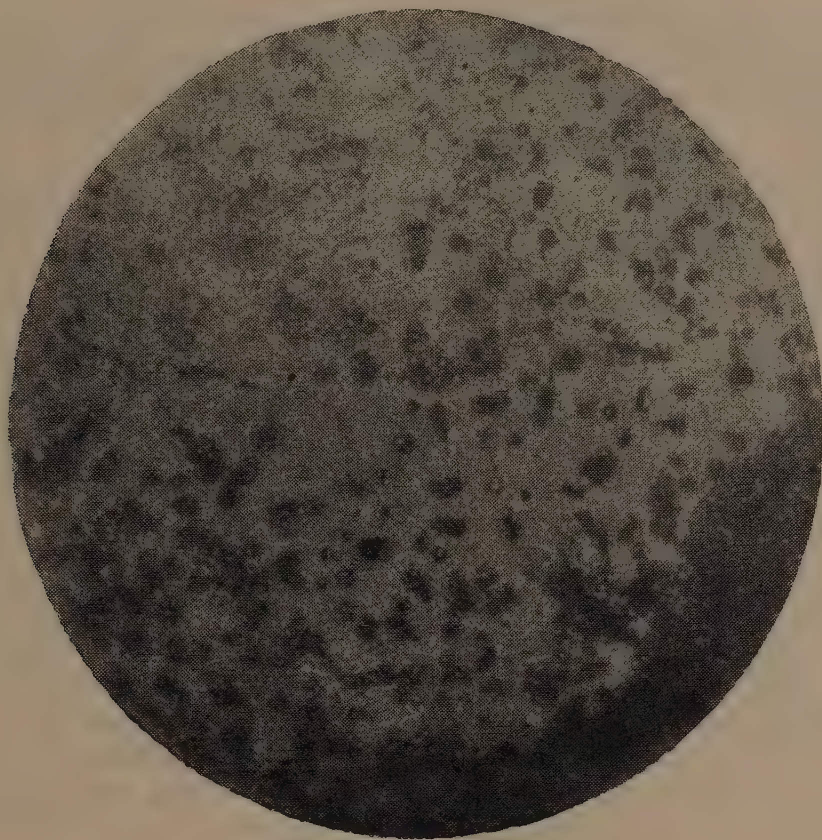


Plate 92.

Bacteriophage Plaques on a Smeared Plate of Streptococcus cremoris.
The plaques can be seen as cleared areas where the starter cells have been lysed.

Since bacteriophages were discovered, there has been considerable controversy as to whether or not they are living organisms. However, they reproduce their kind when lysing a bacterial cell. As reproduction is a fundamental criterion of life, they are probably living. They also exhibit other characteristics of living organisms—they are sensitive to changes in temperature and destroyed by high temperatures; they are destroyed by poisons noted for their effect on living matter, for example chlorine; they are destroyed by ultra-violet light and probably also by direct sunlight, since it contains appreciable amounts of light of the wavelength ultra violet.

Temperature.

Bacteriophage is greatly affected by temperature. In the same way as for bacteria, there is an optimum temperature range for growth. At low temperatures phages are not killed but remain dormant. The number of particles in a filtered phage preparation kept at 5—10 deg. C. will often remain constant for many months. It would appear probable that the length of time such a preparation will remain viable is greatly affected by acidity.

The optimum temperature for phage growth varies with individual phages and it is not necessarily the same as the optimum temperature of the susceptible organism. Starters grow best at 70 to 80°F., but phages tend to develop more readily at 86°F. and some grow just as well at 98°F. At this latter temperature, starter growth is slowed up markedly.

One of the characteristic features of bacteriophages is their resistance to high temperature. They are much more resistant than bacteria. Generally they are killed if kept at 163°F. for 30 minutes, but most will survive 158°F. for 10 to 15 minutes. Thus it will be seen that

pasteurising temperatures, especially those used in the pasteurisation of cheese milk, are too low to have any effect on phage. Heating to at least 180°F. is necessary before it is certain that phage particles are destroyed.

Cross-relationship of Phage Strains.

It has been pointed out previously that either of two species of Streptococcus can be used as a cheese starter—*Streptococcus cremoris* or *Streptococcus lactis.* The starter strains distributed by the Dairy Research Laboratory to Queensland cheese factories are nearly all strains of *Streptococcus cremoris.* The reason for this preference for the cremoris strains is found in the relationships existing between the various strains and the phages attacking them. It is important that the starter cultures used regularly in the factory should be distinct strains—that is, that any one is not attacked by a phage for any other. The starters forwarded to factories are selected with this criterion in view. Of the two species, the *Streptococcus lactis* strains are much more susceptible to phage attack than are the cremoris strains. Further, a phage for a cremoris strain is usually specific for that particular strain, whereas "multiple" phages are commonly associated with lactis strains—that is, a phage isolated on one particular lactis strain will be found to attack many other lactis strains also. Thus if lactis strains are used in a factory and a phage appears for one of these strains, it is quite probable that many of the other lactis strains will also be affected. When cremoris strains are used, this is not so likely to happen.

Phages for lactis strains appear very readily because *Streptococcus lactis* is a common organism in milk and so phages for strains of this species are widely distributed. *Streptococcus cremoris* is much more rare and so phages for it do not appear so readily.

Phage Attack of Mixed Cultures.

All the foregoing discussion of bacteriophage and starter cultures has been concerned entirely with phage attack of single strain starters.

However, mixed commercial cultures are not immune to phage attack. Where a mixed culture is used without any protection from phage contamination, phages will gradually appear for the various strains of the culture. As the numerous strains making up a mixed starter are different and are attacked by different phages, all strains will not be attacked at once. First one strain will be destroyed but the others can carry on producing acid. When the fastest acid-producing strain is destroyed, the culture becomes very slow. A complete stoppage, as happens with single strain cultures, occurs only when all strains in the mixture become phaged.

There have been many instances in Queensland of failure with mixed cultures. Once the phages for the various strains have been built up in the factory, a fresh culture of the same type may last only two or three days. Thus initially a mixed culture may last longer before stopping due to phage attack, but once phages attacking the various strains are present in the factory, mixed cultures are no more resistant to phage attack than are single strains.

EQUIPMENT FOR STARTER CULTURES.

The problem of bacteriophage has caused a complete change in starter propagation methods; so much so that all starter equipment now made is designed especially to prevent bacteriophage infection.

The cultures are usually carried in two, sometimes three, ways, each representing a separate stage in the propagation build-up—namely, pilot cultures, mother cultures and bulk cultures.

Pilot Cultures.

These are the medium through which the culture is maintained from day to day. After this culture is set up each day, the remnant of the clotted culture is used to inoculate the mother culture. The amount of culture is always small, ranging from 5 to 10 ml.

The main reason for the employment of these cultures is that they provide a means of maintaining the starter in small quantities, thus saving space and equipment. This may be a very practical consideration where a large number of starter strains is carried to furnish a rotation. Only the required number of mother cultures for setting the bulk needs then be set up, usually two per day. Not all factories carry pilot cultures, many factories managing to carry all starter strains as mother cultures.

Pilot cultures may be carried in small dropper bottles, or in tubes or small Erlenmeyer flasks closed with cotton-wool plugs.

The small dropper bottle shown in Plate 93 has been successful used for the maintenance of pilot cultures. Such bottles possess the advantage of embodying their own subculturing apparatus in the form of a glass dropper. All parts can be completely and easily dismantled for cleaning.

Small Erlenmeyer flasks for pilot cultures are shown in Plate 94.

Mother Cultures.

These cultures are the first stage of the build-up in starter quantity. They are used to inoculate the bulk starter in cans. The mother cultures are carried in Erlenmeyer flasks of 500—2,000 ml. capacity, closed with cotton-wool plugs. These flasks are also shown in Plate 94.

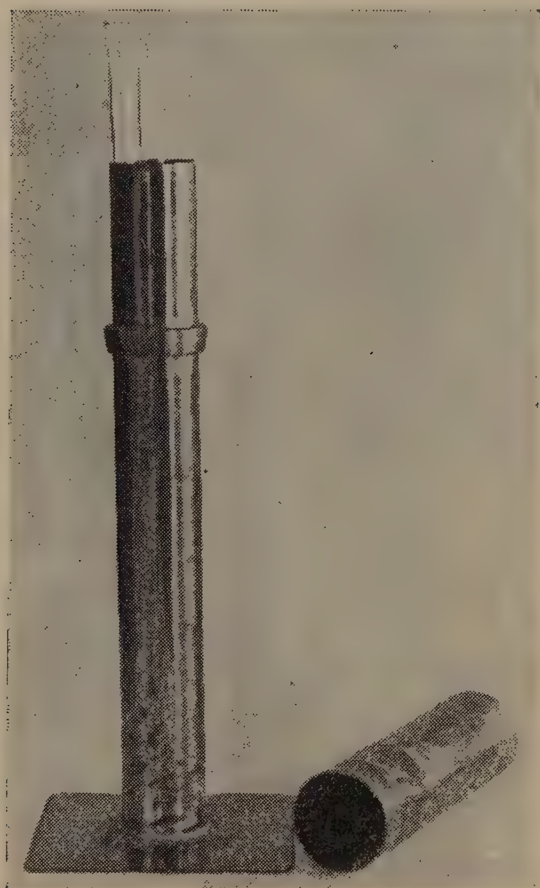
Plate 95 shows a set-up employing the technique of water-seal lids for mother cultures. This method has been tried and proved unsuccessful. Experience in this State has shown that there is no satisfactory substitute for the orthodox system for mother culturing, using Erlenmeyer flasks fitted with cotton-wool plugs.

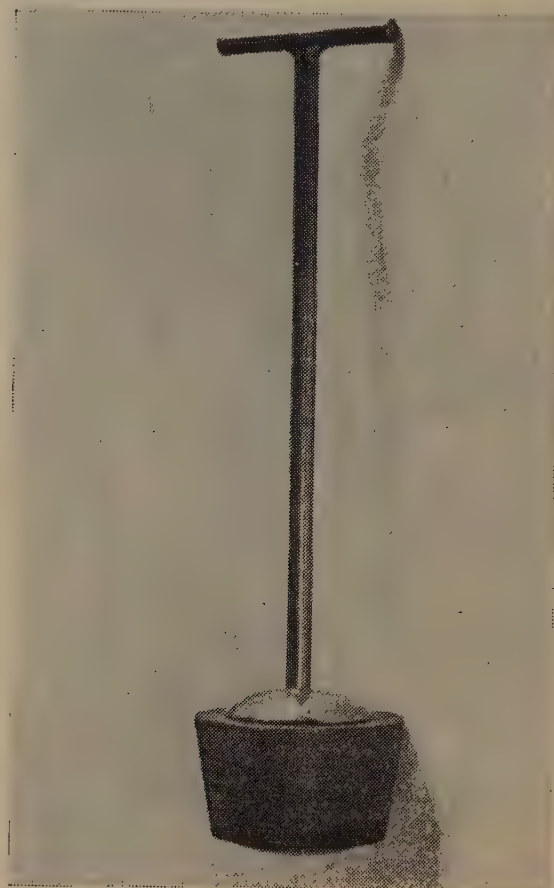
Bulk Cultures.

The bulk starter is used in the cheese vat. This is usually contained in a number of 10-gallon cans, but in larger factories, bulk starter containers of 40-50 gallons capacity are found more practical.

In modern practice, it has been found that ample protection for bulk cultures from bacteriophage attack is provided by completely hooding the starter container with a lid, the sides of which drop down over the sides of the can and form a seal in the surrounding water. This water-seal lid possesses an air intake and an inoculating vent. By closing the inoculating vent with a good-fitting rubber stopper (Plate 93), all air drawn into the can to relieve the vacuum formed during cooling must pass through the air intake vent. This vent is connected to an air filter situated outside the building. The filter is usually of cotton-wool. Attempts have been made to sterilize this air by steam and ultra violet light, but it is considered that these refinements are unnecessary. So long as the cotton-wool filter is of ample size and is kept dry, satisfactory air-filtering is obtained.

An excellent set-up for bulk cultures is shown in Plate 96. This photograph features stainless steel bulk starter cans enclosed in a lidded bulk starter cabinet, which is also of stainless steel. Each starter can is completely hooded by a water-seal lid to which is fitted a central





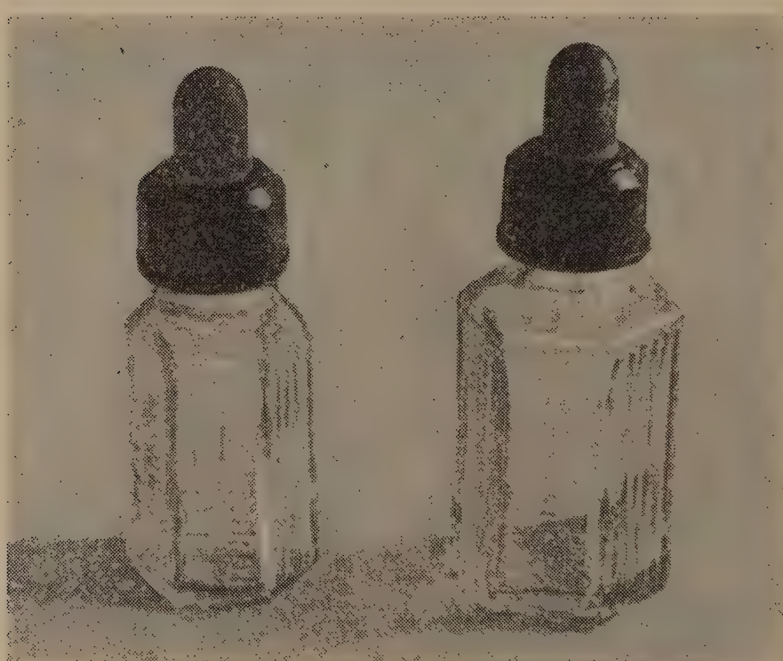


Plate 93.

Equipment for Starter Cultures. Top left, a pipette cylinder containing glass pipettes for mother culture inoculation. Top right, rubber stopper for closing inoculating vents in water-seal lids; the stopper is fitted with a brass handle to keep the hand above the spirit flame and prevent contamination of the rubber stopper by handling. Bottom, dropper bottles which are well adapted for use with pilot cultures.

Plate 94.

Mother Culture Room Equipment. The mother cultures and all materials used in mother culturing are shown in this view of the inside of a mother culture room at a Queensland cheese factory.

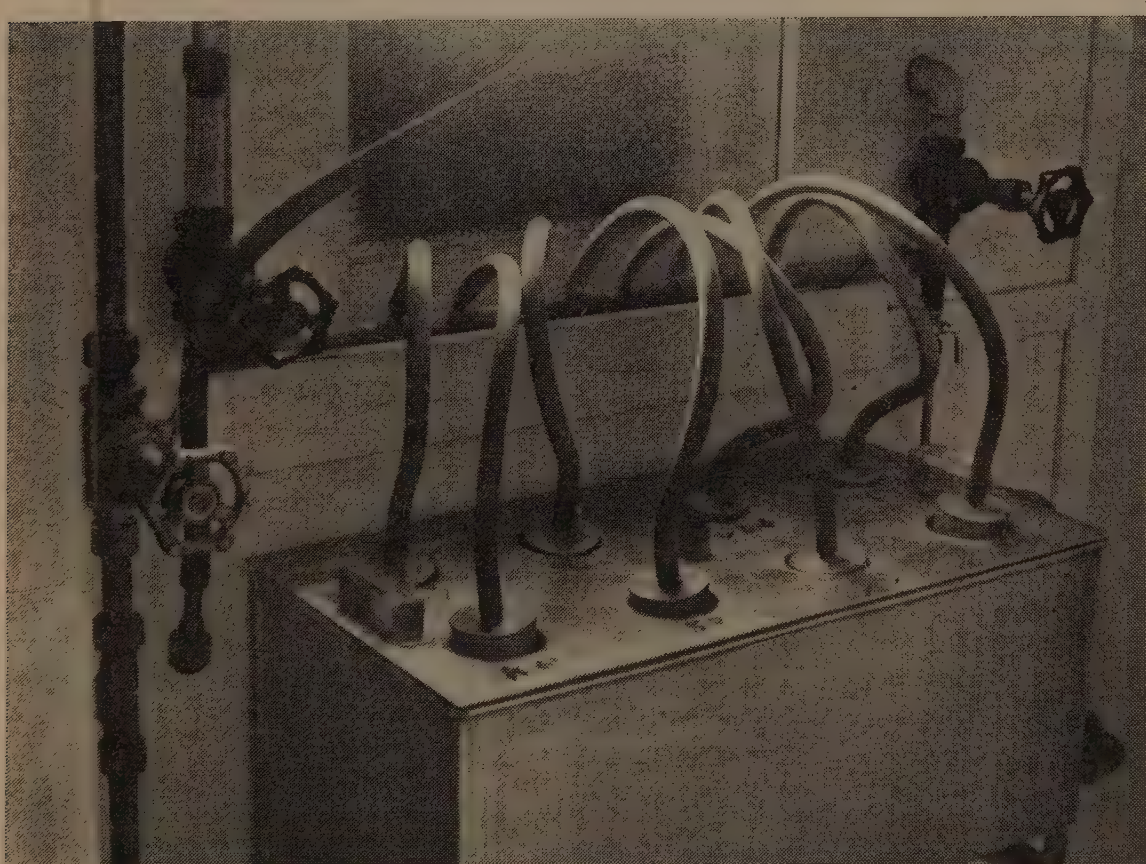


Plate 95.

Mother Culture Set-up Employing Small Water-seal Lids for Mother Culture Flasks. This system has not proved satisfactory.

air vent leading to a filtered air intake. In front of this air intake is situated the 2 in. diameter inoculating vent, which is closed by a rubber stopper fitted with a handle. This photograph also shows a steam ring through which the inoculation was to be made. This steam ring was proved unsatisfactory and the orthodox flame ring has since been resorted to.

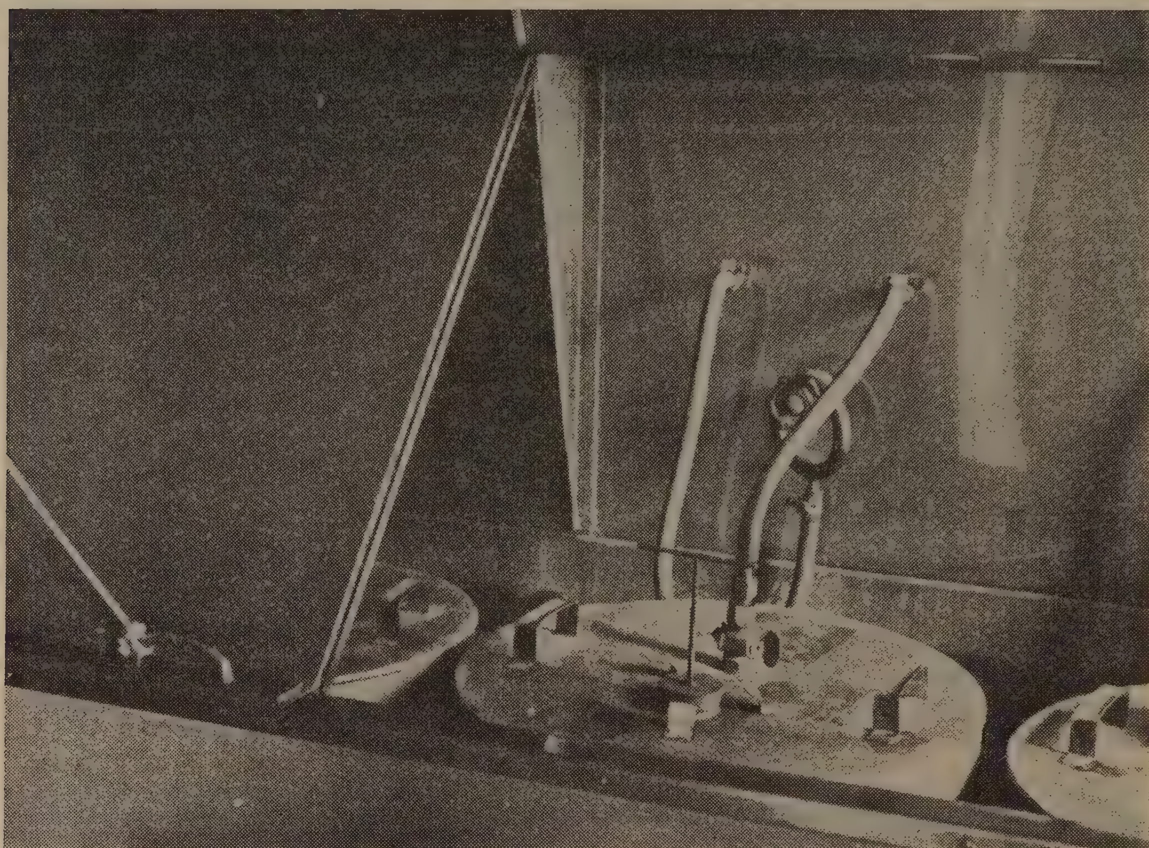


Plate 96.

A Soundly Constructed Bulk Starter Cabinet Containing Bulk Starter Cans Fitted with Water-seal Lids. The air intake line can be clearly seen. The steam ring shown is not satisfactory and spirit flaming is now used instead.

Another more simple bulk starter arrangement is one in which the starter can, which is an ordinary shouldered can of stainless steel, is hooded by a water-seal lid. Heating and cooling of the starter milk is carried out with the can contained in an open rectangular metal vat.

The use of rubber stoppers with handles (Plate 93) for closing inoculating vents has superseded the use of cotton-wool plugs, which have been found to give trouble, particularly by becoming sodden.

The inoculating vents should be constructed from pieces of pipe line accurately machined so as to be squarely faced off and internally chamfered. This will ensure proper sealing of the rubber stopper without its being cut by sharp metal edges.

Several Queensland factories have provided partially or completely insulated bulk starter cabinets. The insulating materials have been caneite and asbestos lagging. Caneite is a light-weight fibre board made from sugar cane fibre. Whilst the insulated cabinets save fuel, give better temperature control and make for cooler conditions in the bulk starter room, the insulation tends to mould and rot, making constant replacement necessary.

(TO BE CONTINUED.)

Brucellosis Testing of Swine.

The Department of Agriculture and Stock is operating a scheme whereby pig herds are tested at intervals for the occurrence of swine brucellosis (contagious abortion).

A herd listed by the Department as ''brucellosis tested'' is one in which all such animals as may be determined by the Director of the Department's Division of Animal Industry have been subjected to two successive tests for brucellosis, at intervals determined by him, without any positive reactors being found.

In order for a herd to be retained on the list of Tested Herds, a semi-annual or annual re-test of the herd, as determined by the Director, is required. If at a re-test any animal gives a positive reaction to the test the herd is removed from the list; it is not listed again until subsequent tests, as determined by the Director, have been carried out.

Full particulars of the Brucellosis Testing of Swine and application forms may be obtained from the Under Secretary, Department of Agriculture and Stock, William Street, Brisbane.

TESTED HERDS.
(AS AT 11th AUGUST, 1952.)

Breed.	Owner's Name and Address of Stud.
Berkshire	J. J. Bailey, " Lucydale " Stud, East Greenmount
	S. Cochrane, " Stanroy " Stud, Felton
	Garrawin Stud Farm Pty. Ltd., 657 Sandgate road, Clayfield
	G. Handley, " Handleigh " Stud, Murphy's Creek
	J. L. Handley, " Meadow Vale " Stud, Lockyer
	R. G. Koplick, " Melan Terez " Stud, Rochedale
	O'Brien and Hickey, " Kildurham " Stud, Jandowae East
	E. Pukallus, " Plainby " Stud, Crow's Nest
	G. C. Traves, " Wynwood " Stud, Oakey
	E. Tumbridge, " Bidwell " Stud, Oakey
	Westbrook Farm Home for Boys, Westbrook
	H. W. Wyatte, Rocky Creek, Yarraman
	H.M. State Farm, " Palen Creek," Palen Creek
	A. R. Ludwig and Sons, " Cryna " Stud, Beaudesert
	H. H. Sellars, " Tabooba " Stud, Beaudesert
	F. Thomas, " Rosevale " Stud, Beaudesert
	D. T. Law, Trouts Road, Aspley
	C. F. W. and B. A. Schellback, " Redvilla " Stud, Kingaroy
	R. H. Crawley, " Rockthorpe " Stud, via Pittsworth
	F. R. J. Cook, "Alstonvilla," Woolvi, via Gympie
	D. E. and E. C. Apelt, "Thelmur," Oakey
	Mrs. I. M. James, "Kenmore" Stud, Cambooya
	H. L. Stark, "Florida," Kalbar
	J. H. N. Stoodley, " Stoodville," Ormiston
	H.M. State Farm, Numinbah
Large White	H. J. Franke and Sons, " Delvue " Stud, Cawdor
	Garrawin Stud Farm Pty. Ltd., 657 Sandgate road, Clayfield
	F. L. Hayward, " Curyo," Jandowae
	J. A. Heading, " Highfields," Murgon
	K. B. Jones, " Cefn " Stud, Pilton
	R. G. Koplick, " Melan Terez " Stud, Rochedale
	R. Postle, " Yarralla " Stud, Pittsworth
	E. J. Bell, " Dorne " Stud, Chinchilla
	L. C. Lobegeiger, " Bremer Valley " Stud, Moorang, via Rosewood
	J. H. G. Blakeney, " Talgai " Stud, Clifton
	H. R. Gibson, " Thistleton " Stud, Maleny
	H.M. State Farm, Numinbah
	K. A. Hancock, " Laurestonvale " Stud, Murgon
	O. H. Horton, Mannuem, Kingaroy

TESTED HERDS—continued.

Breed.	Owners Name and Address of Stud.
Large White—*continued*	V. P. McGoldrick, " Fairymeadow " Stud, Cooroy
	N. Woltmann and Sons, Wooroolin
	R. S. Powell, Kybong, via Gympie
	E. B. Horne, "Kalringal," Wooroolin
	S. T. Fowler, "Kenstan" Stud, Pittsworth
	J. A. and J. McNicol, "Camden," Canning Vale, Warwick
	H. L. Larsen, "Oakway," Kingaroy
Tamworth	S. Kanowski, " Miecho " Stud, Pinelands
	N. R. Potter, " Actonvale " Stud, Wellcamp
	D. F. L. Skerman, " Waverley " Stud, Kaimkillenbun
	A. C. Fletcher, " Myola " Stud, Jimbour
	Salvation Army Home for Boys, Riverview
	F. Thomas, " Rosevale " Stud, Beaudesert
	A. J. Surman, Noble Road, Goodna
	P. V. McKewin, "Wattleglen" Stud, Goombungee
	Department of Agriculture and Stock, Regional Experiment Station, Kairi
	P. V. Campbell, Lawn Hill, Lamington
	E. C. Phillips, "Sunny View," M.S. 90, Kingaroy
	T. A. Stephen, "Withcott," Helidon
	W. F. Kajewski, "Glenroy" Stud, Glencoe
	A. A. Herbst, Bahr Scrub, via Beenleigh
	R. G. Koplick, Grieves Rd., Rochedale
	H.M. State Farm, Numinbah
Wessex Saddleback ..	W. S. Douglas, " Greylight " Stud, Goombungee
	D. Kay and P. Hunting, " Kazan " Stud, Goodna
	E. Sirrett, " Iona Vale " Stud, Kuraby
	C. R. Smith, " Belton Park " Stud, Nara
	H. H. Sellars, " Tabooba " Stud, Beaudesert
	H. Thomas, " Eurara " Stud, Beaudesert
	D. T. Law, Trouts Road, Aspley
	G. J. Wilson, " Glenbella " Stud, Silverleigh
	G. J. Cooper, "Cedar Glen", Yarraman
	J. B. Dunlop, Acacia Road, Kuraby
	A. Curd, Box 35, Jandowae

HAVE YOUR SEEDS TESTED FREE

The Department of Agriculture and Stock examines FREE OF CHARGE samples representing seed purchased by farmers for their own sowing.

The sample submitted should be representative of the bulk and a covering letter should be sent advising despatch of the sample.

MARK YOUR SAMPLE

Sample of .... seed
Drawn from .... bags
Representing a total of ....
Purchased from ....
Name and Address of Sender
Date......................

SIZE OF SAMPLE

Barley -	8 oz.	Oats -	8 oz.
Beans -	8 oz.	Peas -	8 oz.
Grasses	2 oz.	Sorghum	4 oz.
Lucerne	4 oz.	Sudan -	4 oz.
Millets	4 oz.	Wheat -	8 oz.
Vegetable Seeds -	½ oz.		

SEND YOUR SAMPLE TO—**STANDARDS OFFICER, DEPARTMENT OF AGRICULTURE AND STOCK, BRISBANE.**

ASTRONOMICAL DATA FOR QUEENSLAND.

OCTOBER.

Supplied by W. J. Newell, Hon. Secretary of the Astronomical Society of Queensland.

TIMES OF SUNRISE AND SUNSET.

At Brisbane.			MINUTES LATER THAN BRISBANE AT OTHER PLACES.					
Day.	Rise.	Set.	Place.	Rise.	Set.	Place.	Rise.	Set.
	a.m.	p.m.						
1	5.29	5.47	Cairns	36	22	Longreach	38	31
6	5.23	5.49	Charleville ..	28	26	Quilpie	34	36
11	5.18	5.52	Cloncurry	55	45	Rockhampton ..	13	7
16	5.13	5.55	Cunnamulla ..	29	30	Roma	18	16
21	5.07	5.58	Dirranbandi ..	18	20	Townsville ..	30	19
26	5.03	6.01	Emerald	22	16	Winton	44	36
31	5.00	6.04	Hughenden ..	40	30	Warwick	3	4

TIMES OF MOONRISE AND MOONSET.

At Brisbane.

Day.	Rise.	Set.
	p.m.	a.m.
1	3.23	3.37
2	4.30	4.13
3	5.35	4.49
4	6.41	5.24
5	7.47	6.02
6	8.52	6.43
7	9.56	7.28
8	10.55	8.17
9	11.48	9.10
10	..	10.06
	a.m.	
11	12.35	11.03
12	1.16	11.59
		p.m.
13	1.52	12.54
14	2.25	1.48
15	2.54	2.40
16	3.23	3.33
17	3.51	4.26
18	4.20	5.21
19	4.52	6.19
20	5.26	7.19
21	6.06	8.21
22	6.53	9.23
23	7.46	10.24
24	8.46	11.20
25	9.50	..
		a.m.
26	10.57	12.10
	p.m.	
27	12.04	12.55
28	1.10	1.34
29	2.14	2.11
30	3.18	2.45
31	4.22	3.20

MINUTES LATER THAN BRISBANE (SOUTHERN DISTRICTS).

Charleville 27; Cunnamulla 29; Dirranbandi 19; Quilpie 35; Roma 17; Warwick 4.

MINUTES LATER THAN BRISBANE (CENTRAL DISTRICTS).

Day.	Emerald.		Longreach.		Rockhampton.		Winton.	
	Rise.	Set.	Rise.	Set.	Rise.	Set.	Rise.	Set.
1	22	15	38	30	13	6	44	35
6	11	27	26	43	1	18	29	51
11	10	30	26	45	0	21	28	53
16	18	19	33	35	9	10	38	41
21	28	11	44	25	19	0	52	28
26	27	10	43	24	18	0	51	27
31	23	17	39	32	14	8	45	37

MINUTES LATER THAN BRISBANE (NORTHERN DISTRICTS).

Day.	Cairns.		Cloncurry.		Hughenden.		Townsville.	
	Rise.	Set.	Rise.	Set.	Rise.	Set.	Rise.	Set.
1	36	19	55	43	40	28	30	17
3	24	31	46	52	31	37	21	27
5	12	43	38	59	23	45	11	36
7	5	52	35	65	19	50	5	44
9	3	56	34	67	18	53	4	46
11	6	55	35	67	20	52	6	45
13	12	44	38	60	23	46	11	37
15	23	34	46	54	30	29	20	29
17	31	24	51	46	35	32	25	21
19	41	14	57	40	42	25	34	14
21	51	6	65	34	49	20	42	7
23	55	3	68	32	51	18	45	4
25	53	4	67	33	50	19	44	5
27	43	11	60	38	45	23	36	11
29	33	23	52	45	37	30	27	20
31	20	34	44	54	29	39	18	29

Phases of the Moon.—Full Moon, October 3rd, 10.15 p.m.; Last Quarter, October 11th, 5.33 a.m.; New Moon, October 19th, 8.42 a.m.; First Quarter, October 26th, 2.04 p.m.

On October 15th the sun will rise and set about 10 degrees south of true east and true west respectively, and on the 2nd, 16th and 30th the moon will rise and set almost at true east and true west respectively.

Mercury.—An evening object all this month, at the beginning, in the constellation of Virgo, will set 22 minutes after the sun, and at the end of the month, in the constellation of Libra, will set 1¾ hours after the sun.

Venus.—Now very conspicuous in the western evening sky. At the beginning of the month, in the constellation of Virgo, will set 2 hours after the sun, and at the end of the month, in the constellation of Ophiuchus, will set 2½ hours after the sun. The moon will be near Venus on the 21st.

Mars.—Now sets just before midnight. At the beginning of October it will be in the constellation of Ophiuchus, and at the end of the month in the constellation of Sagittarius. The moon will pass Mars on the 24th.

Jupiter.—In the constellation of Aries. At the beginning of the month, will rise between 9 p.m. and 10.15 p.m. and will be near the moon on the 6th. At the end of the month, will rise between 6.30 p.m. and 7.45 p.m.

Saturn.—Now too close in line with the sun for observation.

THE CONSTELLATIONS.

ANDROMEDA (THE CHAINED LADY).

On old star maps this constellation shows the outline of a maiden chained by the waist to a rock. The mythological story of Andromeda has it that Cassiopeia, wife of Cepheus, King of Ethiopia, boasted that she was more beautiful than the Sea Nymphs, who in revenge persuaded Poseidon (Neptune) to inundate the land and send a sea monster to ravage the coasts. The royal pair consulted the Oracle and were told that calamity could be averted only by the sacrifice of their daughter Andromeda to the monster. So Andromeda was chained to a rock by the shore and left to her fate. Perseus, returning after overthrowing the Gorgon Medusa, saw her plight and went to her rescue. He confronted the monster with the Medusa's head and turned it to stone. Andromeda and Perseus married and after a happy life were translated to the skies.

Andromeda lies mainly between declination 30 degrees and 50 degrees north and so is fairly well situated for observation from most of our State, particularly about the end of November, when it is fairly equally spread on either side of the meridian at about 8 p.m. Alpheratz (Alpha Andromedae) forms the lower right hand corner of the Great Square of Pegasus as viewed from the southern hemisphere and is a spectroscopic binary. Delta, Beta and Gamma in that order form a wide arc to the eastward of Alpha. On a clear moonless night it is possible to locate the Great Andromeda Nebula, M 31, with the naked eye, where it appears as a faint blur to the north-east of Alpheratz. If you imagine a tall isosceles triangle with Beta and M 31 at each end of the base, and Alpha at the apex, it should be easily found. Telescopes will show it as definitely oval in shape, but a very large instrument is necessary to show its structure. The 100-inch Hooker telescope and the 200-inch Hale telescope resolve parts of it into stellar points, some of which show cepheid variations, a fact which has been used to check its distance from us—about 800,000 light years. M 31 is another stellar system comparable in size with our own galaxy and is the nearest of these extra-galactic systems to our own system.

LACERTA (THE LIZARD).

This is a small, inconspicuous group to the north of Pegasus and adjoining Andromeda and Cygnus. Its stars, which are only of 4th magnitude, are lost in the haze of the horizon from our latitudes.

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DEPARTMENT OF AGRICULTURE

QUEENSLAND AGRICULTURAL JOURNAL

A South Burnett Peanut Crop

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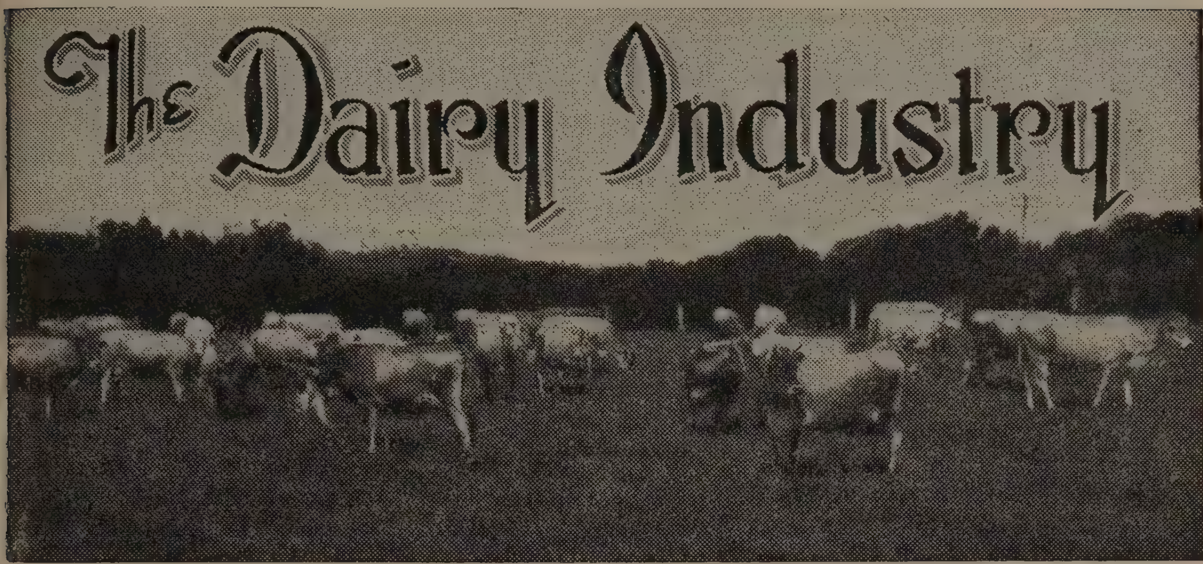

Observations on Dairying in Pakistan.

E. B. RICE, Director of Dairying.

(*Continued from page* 154 *of the September issue.*)

UTILISATION OF MILK.

The total milk production in Pakistan of 1,250 million gallons is roughly utilised in the proportions of one-third each for the fluid milk market, ghee and the indigenous milk products. Their value is estimated at approximately £450,000,000 yearly. The estimated values of other major primary commodities are—

Rice	£866,000,000
Wheat	£130,000,000
Jute	£120,000,000
Cotton	£60,000,000

Butter is chiefly consumed by people of moderate and higher incomes. It absorbs only a relatively minor proportion of the nation's milk production. Even those who eat butter have a low per capita consumption. Cheese is not manufactured on a factory scale, although there are two types of cheese. One resembling the cottage cheese of western countries is made by some villagers in West Pakistan. The other is a semi-hard rennet type. Its production takes place chiefly in East Pakistan, where it is called Dacca cheese. Powdered milk is not manufactured and only one factory makes evaporated milk. This is a military dairy, the output of which is entirely for military personnel. It is fortunate that the buttermilk, known in Pakistan as lassi, obtained from the churning of milk in the course of ghee making, is relished by villagers and thus goes to the feeding of the human population instead of stock as in many countries.

THE COLLECTION, TRANSPORT, TREATMENT AND DISTRIBUTION OF MILK.

The milk supply of towns is derived from two sources:—(*a*) milk produced by stock kept within the town area; and (*b*) milk transported from villages to towns for retail sale.

Town-produced Milk.

The city milk producer, with few exceptions, owns only a few cows or buffaloes. The milk is usually vended to consumers by the owner.

The large numbers of cows and buffaloes kept inside the towns usually do not nearly satisfy the town demand for milk, the deficit being wholly or partly made up from supplies conveyed into the towns from neighbouring villages. Since Partition the problem of ensuring an adequate milk supply for the towns has become accentuated by the large influx of refugees; in many towns the human population has increased fourfold since 1947. Estimates of availability of town-produced milk varied from 6 per cent. to 90 per cent. for different towns.

Village-produced Milk.

The villagers living in the irrigated tracts generally have sufficient milk for their own domestic needs. It is usual for them to convert the milk into ghee for their own use and for sale, and in doing so, the lassi (buttermilk obtained in the village system of first converting milk into desi, or country butter, as an intermediate stage in gheemaking) is consumed. This contains most of the nutritive constituents of milk, except fat, which is present to the extent of about 1.5 per cent. It represents a good substitute for whole milk.

In the non-irrigated areas the villagers generally do not have sufficient milk, although they are generally better off in this respect than urban people. Unfortunately, there is a tendency for the cultivators in villages who supply milk for the liquid milk trade to deprive themselves by disposing of as much as possible of their milk for this trade.

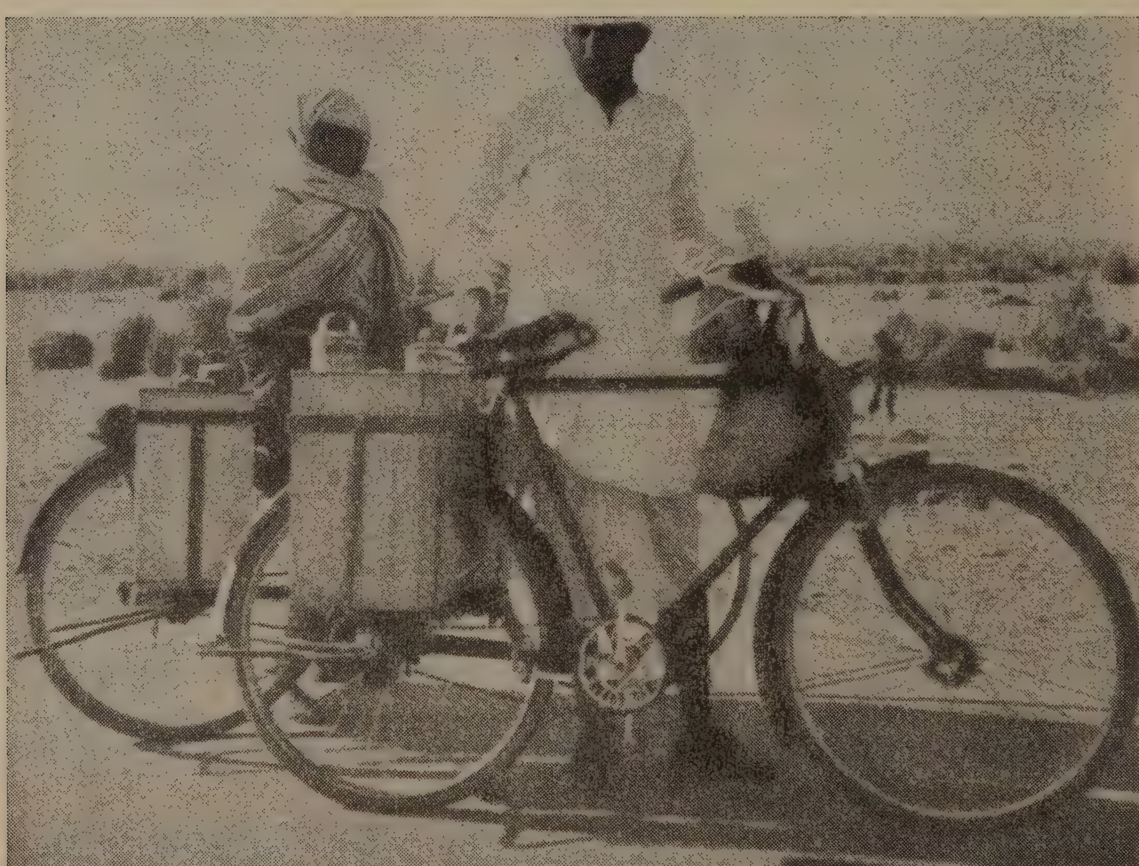

Plate 97.

Milk Being Taken from a Village to Town by Bicycle. Note the oblong milk cans.

Plate 98.

Milk Being Conveyed by Donkey. Note the straw in the mouth of the vessel.

Plate 99.

Milk in Vessels at a Village Collecting Centre. Note the various types of vessels used.

Milk from villages in close proximity to towns is taken into the towns mostly by the producer himself. For distances up to three miles, headload is a common means of delivery, while bicycles, packloads on donkeys or horses, or horse-drawn carts may be used by villagers living up to 10 miles out of the towns. For these distances, middlemen, who make loans to villagers who contract to supply a stipulated quantity of milk daily, often travel with bicycles or horse-carts to collect the milk and take it into the towns. Beyond about 10 miles, motor trucks pick up milk at certain collecting points on the road, where it is brought by means of headload, donkey, horse or bicycle by each individual producer in adjacent villages up to three and even five miles from the collecting centre. At the collecting points, agents or middlemen take delivery from the producer and tip the milk into cans or brass vessels having capacities of from 2 to 8 gallons, which are loaded on to the motor truck for the farther journey into the town.

Milk is also conveyed to the towns by rail from villages adjacent to the railway lines. The unorganised system and waste of time is again evident, as the producer usually travels on the train with his own milk to the town or one villager will travel to look after the produce of a number of his neighbours.

In only one city has an attempt been made to place the collection, transport and treatment of milk on an organised basis. This scheme was inaugurated about 10 years ago by a proprietary company in Lahore, which also has the only milk pasteurisation dairy in Pakistan, except those on the military farms. This company has motor trucks which go out to villages farther from the city (20 to 30 miles) than milk can be drawn by horse-cart or bicycle. It has collecting centres on the roadside from which it buys milk, which is measured and strained through muslin into its own cans. Agents financed by the company and working on a commission buy the small quantity of milk available from each villager and convey the bulked milk to the various collecting points. In the summer months ice is used to cool the milk during transit. This system is only applicable where there are good roads between the city and collecting stations. Systematic development of similar schemes for other large towns does seem to offer a useful means of augmenting the supplies so vital to meet the needs of the swollen town populations since Partition.

Treatment of Milk for Town Trade.

Milk pasteurising establishments similar to those of Australia and western countries are almost non-existent in Pakistan. Military farms pasteurise milk only for armed services requirements. There is only one other pasteurisation plant, which is located in Lahore. At this factory, milk is heated by the flash process to 185 deg. F., cooled and bottled. Another privately owned dairy near Karachi does, however, bottle the raw milk produced from its own herd, though its output is quite small. The widespread malpractices in the milk distribution trade and lack of public appreciation of proper milk handling make it difficult for these concerns to extend their operations.

It is the universal custom for householders in towns and people in villages to boil all milk before using it in the home. However, the lack of subsequent care soon leads to contamination and greatly impairs keeping quality. It is found necessary to re-heat every four hours during the hot months of the year to avoid souring. This custom must

undoubtedly greatly lessen any risk of transmission of milk-borne diseases to the human population and in the circumstances makes the pasteurisation of town milk supplies, as commonly adopted in other countries, not of immediate importance. It is not meant to imply that pasteurisation should be officially discouraged, but to point out that at the present time it is of secondary importance to improving the hygiene of milk production and handling, devising measures for more efficient collection and transport of the milk supply for towns and increasing the supply to ensure adequate amounts. While the present deficiency of supply in the towns continues and a relatively large proportion is produced in the towns under costly conditions, malpractices will be difficult, if not quite impossible, to stamp out. Only a full supply can help to reduce the cost to the consumer and eliminate malpractices, such as adulteration with water, so frequently done to maintain a uniform supply at all seasons of the year and to enable the producers and vendors to sell without monetary loss.

Plate 100.

A Well-Equipped Milk Pasteurising and Buttermaking Factory on a Military Dairy Farm.

The Retail Milk-distributive Trade.

Town milk producers generally sell the milk produced by them to customers by personal house to house delivery. A similar direct service from producer to consumer is common for producers living up to three to five miles from the towns. Milk from the more distant villages passes through the hands of one or more middlemen before reaching the consumer either through delivery by a vendor or direct purchase from a shop.

Milk sold in shops in the town bazaars is frequently heated and kept simmering over a slow fire all day, any not sold being converted to dahi or khoa. Many of these town dairies also make some household deliveries by foot, bicycle or tonga. In general, these dairies purchase milk from a middleman who obtains it direct from the village producers or employ their own collectors. In the bazaar milk shops the milk is exposed to contamination by dust and flies and generally handled most unsatisfactorily.

Plate 101.
Milk Simmering Over an Oven at a Town Bazaar Milk Shop.

The quantity of milk delivered by the household retail vendor is often quite small. A vendor using a bicycle would seldom carry over 60 seers (approximately 12 gallons), while by headload or the hand-carrying of the milk vessel, the quantity would be less.

MILK PRODUCTS.

Butter, cheese, condensed and powdered milk, products manufactured on a large factory scale in most dairying countries of the world, occupy a very minor place in connection with the utilisation of milk in Pakistan. Lack of good all-weather roads, the effect of summer climate on the keeping quality of milk, the small quantity produced by each individual owner and collectively in most villages, and conservatism in regard to changing centuries-old village customs, are all impediments to developing dairy manufacturing enterprises of the conventional western kind. In Pakistan, two-thirds of all milk produced is used for making indigenous milk products such as ghee, dahi, khoa and others. Per capita consumption of creamery butter is very low. European varieties of cheese do not appeal to the Pakistani palate and are too costly for the mass of the people. The small quantities imported are purchased only by the few European residents.

In countries where butter and cheese are manufactured extensively in large factories the by-products, which are of high biological value, are often fed rather wastefully to lower animals. Excepting ghee, the indigenous milk products of Pakistan conserve most of the nutrients of milk, and even in making ghee by the village method the buttermilk, known as lassi, which is drained off at an intermediate stage in the process, is practically all consumed by the villagers, by whom it is relished as a beverage.

It is, then, of foremost importance to cater for the dietary habits of the people and stimulate improved practices in manufacturing the indigenous products, which conserve most of the chief nutrients of milk, rather than to encourage large-scale butter and cheese manufacture, which also often results in loss of the chief milk nutrients as human foodstuffs.

The indigenous milk products for the villager's own domestic use, or for sale for cash, are made on a cottage-industries basis.

Creamery Butter.

In the larger towns, butter is made by numbers of small shopkeepers and a few very small dairies. The amount made per maker may vary from as little as 10 lb. to 200 lb. daily. Some dairies buy cream from producers, while others have separators. In a few cases the cream is heated in a vessel placed directly over the fire, but mostly there is no heat treatment. The cream is churned by hand agitation in galvanised iron tubs, or in small wooden or metal churns manually operated. Prior to churning, the cream is cooled in summer by town mains water, and ice is often added with the break-water.

The general quality of the butter sold is poor. It has "off" flavours and the body and texture are weak. Butter made from buffalo milk is of white colour. It is common to churn a mixture of cream from the milk of cows and buffaloes and to add colour to bring the product to the desired yellow colour. Butter is made on a larger scale at the military farms with a modern type churn fitted with internal worker rollers, but this butter is supplied only to armed services personnel.

Evaporated Milk.

Evaporated milk is manufactured at a well equipped factory at the Military Farms, Okara. Up to 4,500 gallons of buffalo milk produced on the farm are treated daily. The whole output is taken for use by the armed services.

Powdered and Condensed Milk.

Two small condenseries previously in operation ceased manufacture some years ago, while powdered milk is not made. There is, however, a substantial quantity of imported, powdered and condensed milk sold in Pakistan. There is a prejudice against powdered milk among a large proportion of the population, and in any case, the lack of suitable roads in most districts and unhygienic milk production practices would prevent the establishment of large factories to handle these products.

Indigenous Milk Products.

The indigenous milk products, all evolved to suit the local conditions, are of major importance in the dairying economy and nutrition of the people of Pakistan. They are ghee, dahi, makhan, lassi, khoa, channa, kheer, rabree and malai.

Ghee.

Ghee is essentially clarified butterfat. It is made by first curdling milk and then churning it to the indigenous butter, makhan. This is next heated to drive off water, and the curd which rises to the surface is also skimmed off. Various combinations of time and temperature are

used for converting milk into ghee, according to local customs. Ghee not needed for village domestic use is sold to ghee packers, who blend and refine it before wholesaling. Ghee is used extensively for cooking and being more or less pure fat, will keep in the tropical climate for six to eight months. Because of the higher fat percentage, buffalo milk is preferred to cow's milk for ghee production, although commercial ghee is usually a mixture of fats of the milk of cows and buffaloes. The annual production, estimated at over 100,000 tons, is valued at £A70,000,000. Colour, grain structure, flavour and aroma are important criteria of market quality.

Adulteration of ghee is common and detection is difficult, owing to the laborious chemical analyses required and the range of physical constants. The chief adulterants are hydrogenated vegetable oils, animal fats, vegetable oils, starch and white petroleum jelly.

Under village conditions much wastage occurs during ghee making. It was reported that only about two-thirds of the fat is recovered. On military farms using better equipment, the recovery is as high as 90 per cent. There obviously is scope for investigations to be carried out with a view to devising simple, cheap and efficient equipment for the small-scale village method of making ghee.

There is a national ghee grading scheme, produce submitted thereto and conforming with the prescribed specifications being permitted to bear the Pakmark brand. However, this scheme is not widely availed of by ghee blenders, and owing to the existing shortage, the public is willing to buy ghee which is not officially graded.

The Government has a Central Ghee Control Laboratory. Under the Pakmark scheme, authorised ghee blenders and packers are required to provide a laboratory at approved ghee-making centres to analyse ghee for purity and grade it under the supervision of Government chemists. Frequent official inspections are made of the grading centres and check samples are taken for examination at the Central Laboratory. The approved packers buy the ghee from villagers and take it to the approved centres for refining, which consists of blending, heating and removal of extraneous material. The heating is done in a conical shaped iron vessel placed directly over a fire.

Dahi.

Dahi is prepared by curdling milk by means of a lactic acid culture. The culture used is a portion (1 to 3 per cent.) of the previous day's make. Dahi is consumed alone or mixed with rice; salt or sugar may be added to suit the taste of the consumer. The desired acidity varies from 0.6 to 1.0 per cent. and good dahi has a smooth texture free from gash holes. When made for retail sale, a shallow vessel is used to give a product of better appearance by concentrating the layer of fat on the surface; 50 to 85 per cent. of the fat may be in this layer.

The amount consumed, though considerable, is relatively low in comparison with that used for churning by a wooden paddle in a small metal or earthen pot into the indigenous butter, makhan.

Makhan (desi or country butter).

The method of making was briefly described in connection with dahi. The dahi is made from combined morning and evening milk and is churned daily. Makhan being essentially an intermediate product in

ghee making, there is little control of acidity developed or the quantity of water added. The loss of fat in such conditions may be as high as 25 per cent., depending upon the season of the year. Even if made daily the loss is 8 to 10 per cent. Since the country butter may be kept several days before being converted into ghee, undesirable fermentations cause the development of free fatty acids and other defects. The villagers also use makhan to spread on chappaties, the village equivalent of bread.

Plate 102.

The Village Method of Churning Makhan ("Country" Butter). This task is usually done by the village women.

Lassi.

This is somewhat akin to buttermilk obtained as a by-product in modern factory buttermaking. It is a refreshing beverage much appreciated by the people of West Pakistan. It can be regarded as a valuable part of the diet of the villagers, and it is fortunate that it is relished by them and not wastefully fed to stock as is so often the case with the buttermilk obtained in buttermaking in other countries.

Khoa.

Khoa, which may be likened to milk powder, is prepared by heating wholemilk over a brisk fire in a shallow, flat-bottomed iron pan, using a flattened iron stirrer to continuously stir with a circular motion. About 5 lb. milk is used per batch. Skill is required to prevent the semi-solid milk as it condenses from being burnt and browned. The process takes about 15 minutes. The final product should be white in colour, smooth to the palate, not have a rubbery feeling and not exude fat and water. It keeps for about three to four days and is eaten alone or used for preparing sweets.

Adulterants, such as rice flour and other cereal flours, are often added to khoa.

Channa.

This product is made in East Pakistan by coagulating milk heated almost to the boiling point with lactic acid (whey culture obtained from the previous day's make) or citric acid (lime juice). The hot milk, which is vigorously stirred during the addition, curdles at once. The clot is drained through muslin to remove some moisture (whey). Large quantities of channa are used for making sweets in East Pakistan.

Miscellaneous.

Other indigenous milk products made on a scale which does not appreciably affect the proportion of the nation's milk production diverted to their manufacture are kheer, rabree and malai. Products of Australia, New Zealand and western dairying countries to which they are somewhat akin are, in the case of the two first mentioned, condensed milk, and in the latter case, clotted cream.

SUMMARY.

The indigenous stock and milk products fit in with the specific environmental conditions of Pakistan and the dietary habits of the people, but it is urgently necessary to apply scientific methods and modern techniques to raise the milk yields of the stock, ensure a better quality and more adequate supply of milk for the people and improve the processing methods, quality and marketing of the indigenous milk products.

PESTS AND DISEASES HANDBOOK.

The Department of Agriculture and Stock now has available for sale the second edition of Volume III. of the "Queensland Agricultural and Pastoral Handbook," the first edition of which appeared in 1938.

Following a general description of the structure of insects, fungi and bacteria, and a chapter on insecticides and fungicides, the book proceeds with a discussion of the pests and diseases which affect most of the farm and orchard crops grown in Queensland. The insects, fungi and bacteria concerned are described and illustrated, the symptoms of injury detailed, and control measures given.

Among the crops treated are deciduous fruits, citrus, banana, pineapple, papaw and other subtropical fruits, cereals, cotton, tobacco, lucerne, potato, tomato, vegetables, and pastures. There is also a chapter on pests of stored products.

The book runs to 560 pages and contains more than 300 illustrations. It is available to primary producers in Queensland for ten shillings, post free, and to others for fifteen shillings, post free.

The Maintenance of Phage-Free Cheese Starter Cultures.

V. R. SMYTHE and L. G. LIGHTBODY, Dairy Research Laboratory, Toowoomba.

(*Continued from page 182 of the September issue.*)

STERILIZATION OF MILK AND EQUIPMENT.

The milk for cultures may be either whole or separated. The presence or absence of fat is immaterial. It is the practice in some factories to pre-sterilize empty flasks before filling with milk. This sterilization has no value—the only requirement is that the glassware be clean.

Prolonged heating of the milk causes it to become slightly brownish. Although such culture milk may appear unsightly it is apparently without detriment to starter growth. When this discolouration is noticed, the duration of heating may be reduced.

It has been the practice in many cheese factories to select milk from a particular supplier for use as starter milk. This practice is not to be recommended because any anti-bacterial property in this milk will have full sway and may affect starter development. Indeed, several instances have occurred where a selected supplier's milk, which has been excellent as judged by milk quality tests, has failed to permit normal starter growth. It is safer to take bulk milk so that any bactericidal agency is diluted.

The container for pilot and mother cultures should not be overfilled, particularly so with mother culture flasks, since overfilling tends to promote wet cotton-wool plugs. Such plugs must not be too tight, since this also will give a tendency to wet plugs. The cotton-wool plug is intended to be a filter, not an airtight closure. With screw-topped pilot culture vessels, the top must be loosened slightly during sterilization.

Mother culture and pilot culture milks are sterilized in the mother culture steamer for at least one hour.

Pipettes can be placed in the pipette cylinder and sterilized in the mother culture steamer, after which they can be carried in this cylinder from the sterilizer to the place of subculturing. Mother culture flasks of milk may be cooled in the steamer by running in water at 75-80°F. for approximately one hour, but dropping bottles for pilot cultures are usually of poorer glass and must be taken from the steamer, screwed down and allowed to cool in the air.

The bulk culture milk is sterilized most often in the bulk starter containers, usually 10-gallon cans, contained in a rectangular vat of water. The heating is by steam and should be continued for at least one hour at 200°F. or above. Allowing half an hour for milk to reach temperature, the total period of heating would then be not less than 1½ hours. When the water reaches 200°F. or thereabouts, the steam must be cut back to prevent excessive turbulence of the water. Sometimes the bulk starter milk is heated by direct steam, which gives a higher temperature than that attained by steam injection into water, but the milk should be heated for a similar period.

PROPAGATION TECHNIQUES.

All subculturing techniques are based on the fact that culture milk and starter apparatus, once properly sterilized, will be entirely free from all living organisms and will remain so until inoculated with the starter organism, or until they become contaminated from external sources. No surface, however clean, must be allowed contact with starter until it is sterilized. Any surface which has been sterilized and then left exposed to air must be flamed before use.

In addition to observing these principles, there are other precautions which have to be taken in starter propagation. These extra precautions are aimed at preventing contamination with bacteriophage.

In subculturing, a method should be evolved and adhered to rigidly. The cultures should be set out in order with the inoculated milks. After transfer of a small quantity of the clotted culture into the new culture, the latter should be immediately labelled and both old and new cultures put to one side before going on with the next inoculation. In this way the chance of failing to inoculate a culture, of mixing cultures through double inoculation, or of mislabelling cultures, is eliminated.

Pilot Cultures.

When dropper bottles are used for pilot cultures, inoculation from one bottle to another is effected quickly by using the teat and glass dropper. Flaming of the necks of the bottles can be omitted if care is taken not to touch the necks, and if transfer is very rapid.

Inoculation of the tubes can be carried out by using sterilized glass pipettes or an inoculating loop flamed between each culture. In the case of the small Erlenmeyer flasks, subculturing should be by pipette inoculation only, because a loop will deliver too small a quantity.

Mother Cultures.

Inoculation of mother cultures should be done by means of pipettes made from glass tubing. After thoroughly flaming the cotton-wool plugs and necks of the flasks, the cotton-wool plug should be removed just far enough to allow entry of the pipette. Transfer must be as rapid as possible, and no attempt should be made to measure the amount of culture transferred. Approximately 5-10 ml. is the usual amount.

Bulk Cultures.

Before any inoculations are made of bulk starter milk, care must be taken to see that the milk is properly cooled. Because there is a considerable lag between the temperature of the milk and the temperature of the cooling water, the water temperature may be misleading. It is impracticable to take the temperature of the milk without risking contamination, so the best guide is to gauge the temperature by holding the hand to the outside of the cans below water level.

The clotted mother culture should first be broken up to a smooth consistency by swirling in the mother culture flask. Inoculation of the bulk culture is done by flaming the cotton-wool plug and neck of the mother culture flask and quickly pouring a quantity of mother culture through the inoculating vent in the water-seal lid. The pouring is done through a cone of flame formed from a flame ring placed round the vent. The flame ring is shown in Plate 103. After inoculation,

the vent is closed with the rubber stopper before the flame ring is removed. As with mother culture inoculation, there is no need to measure the quantity of culture added. With single strain cultures, a quarter of a pint is just as satisfactory to inoculate 10 gallons of milk as half a pint, provided the temperature of the bulk starter is kept fairly constant at 70-75°F. Stirring of the inoculated milk is unnecessary for starter development, and is to be avoided because of the likelihood of contamination. The inoculation of a bulk culture can is shown in Plate 104. This photograph exhibits the flame ring in position with the rubber stopper removed.

Plate 103.

The Methylated Spirit Flame Ring Through Which the Inoculum is Poured into the Bulk Starter Cans.

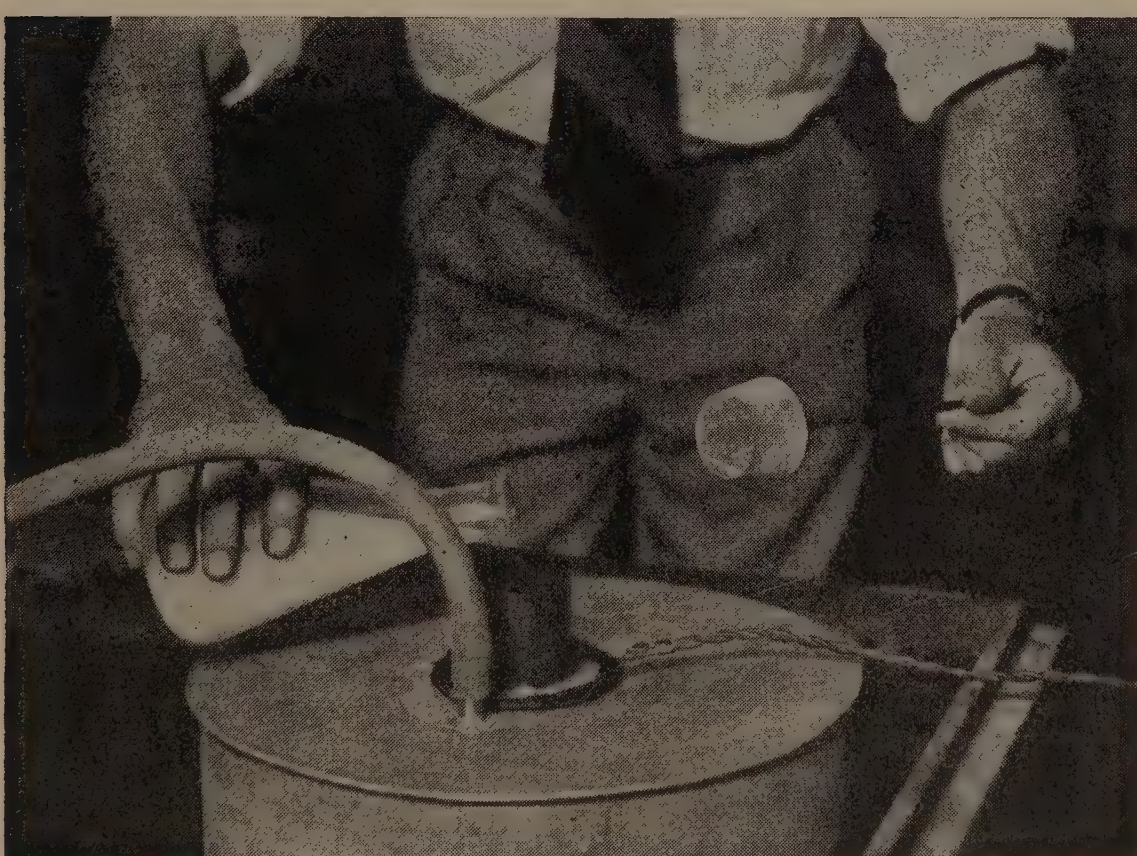

Plate 104.

Inoculation of Bulk Starter Cans. The rubber stopper is held clear while the inoculum is poured through the ring of flame.

Personal Element in Starter Propagation.

The person performing the subculturing has it in his power to succeed or fail in propagating the starter in an active, contamination-free state. This truth will stand elaboration, for, besides providing the most important source of starter contamination, this person determines the methods that are used in propagation and what precautions are taken. Factory experience has shown repeatedly that one operative will allow starters to be contaminated under conditions and using equipment which should be conducive to most successful starter work. On the other hand, another operative can maintain starters for long periods uncontaminated under conditions which would appear difficult and with equipment which may seem rough. It is to be concluded from this that—

(1) Elaborate apparatus is unnecessary for starter propagation—however rough it may be, it must be of sound design and construction;

(2) The personal element in starter subculturing is more important than any other factor—the careful operative who is attentive to detail will succeed whereas the operative who is careless will surely fail.

Contamination from Personnel.

The operative subculturing may contaminate the starters from his person and his clothing, particularly so when he has been working at the vats and is in the habit of setting up the starters after the day's cheese manufacture is completed. Under these conditions his person and clothing will usually be carrying bacteriophage. All skin not only carries a heavy bacterial population, but is extremely difficult to sterilize. Hands, the skin of which is usually thickened and deeply furrowed, are particularly heavy sources of contamination.

In order to guard against contamination from himself, the operative is advised to pay attention to the following precautions:—

(1) Thoroughly wash hands and arms with soap and water; dry them on a clean towel.

(2) Change clothes soiled as result of work at vats. This applies particularly to clothing splashed with whey. Don either overalls or apron kept at starter room for use only during starter propagation work.

(3) In subculturing, do not touch any part of flasks or subculturing apparatus with which starter comes in contact.

(4) Flame pipettes, necks of flasks and any surface which has been exposed to air before performing subculturing.

(5) Perform all inoculations as quickly as possible while still observing all precautions. Thus, do not attempt to accurately measure the amount of clotted culture used as inoculum.

Starter Maintenance in Large Factories.

Large cheese factories present special starter problems. One large Queensland factory has a peak of 18,000 gallons of milk daily which is handled in nine vats, employing two shifts. The amount of bulk starter required to set this milk would necessitate some 20 ten-gallon cans, which large number becomes unwieldy.

The problem has been solved by employing large bulk starter containers of 40-50 gallons capacity. Each is made as a separate unit in stainless steel and is fitted with a water jacket and water-seal lid. The filtered air intake to the cabinets is from a manifold leading to an air filter outside the factory. This bulk starter set-up is shown in Plate 105. Each starter cabinet is fitted with a draw-off cock, through which the starter is run into cans and conveyed to the vats. A dial thermometer, with bulb penetrating through to the milk compartment, provides temperature registration for each cabinet.

Plate 105.

Arrangement for Bulk Starter in a Large Cheese Factory. Five bulk starter cabinets, each of 40-50 gallons capacity, can be seen.

Filling of the cabinets with skim milk is by pipeline from a high-level stainless steel vat. Heating of the water is by steam through a silencer and cooling is by circulation of cold water. Provision is also made for circulation of chilled water for greater cooling intensity.

Mother cultures are carried in two-litre Erlenmeyer flasks and are propagated in the factory's own laboratory, well isolated from the cheese factory. Inoculation of the bulk cultures is done by either the starter room personnel or the laboratory staff and not by persons working at the vats.

BACTERIOPHAGE TESTS.

Examination of samples for bacteriophage may be conducted in three ways—culture tests or plaque tests for single strain starters and acid production tests for mixed cultures.

Before any samples can be tested, they must first be passed through a Seitz filter to remove all bacterial cells. Any phage present will pass through the pores of the filter-pad into the filtrate, which is then used for the tests.

For the cultural tests, a small portion of the filtered sample is added to a freshly set up starter culture in milk, which is then incubated at 30°C. for 4 hours. After this period of incubation, a smear is made from the test, stained and examined microscopically. The growth obtained in this test is compared with that obtained in a control culture (a culture of the same starter set up at the same time and similarly incubated). If phage was present in the sample tested, the starter culture will be destroyed in the four hours.

Plaque tests can also be employed for testing for the presence of phage for single strain starters. This method may be more convenient where there is a very large number of tests to be conducted, but the method is not as simple as that involving culture tests, and results are not obtained as quickly.

A tube of the media to be used is poured on to a Petri dish which has been marked in squares. When the media has set, two drops of culture are put on its surface and smeared evenly. The surface of the media is then dried before the samples to be tested are put on the plate. A small loopful of filtrate is used as inoculum and is placed on the surface of the media in one of the squares. When all inoculations are complete, the plate is incubated at 30°C. for 24 hours. It is then examined for cleared areas or plaques in the surface film of growing culture. The plaques are due to bacteriophage which prevents the growth of the culture.

If a mixed starter culture is in use, slowness or starter failures may still be due to bacteriophage infection. However, it is more difficult to show that phage is present, for the cultural tests and plaque tests explained above cannot be used. Usually not all the strains in the mixed culture are destroyed, and there would be some growth in the milk or on the plate. To test for phage for mixed cultures, a modified vitality test or acidity production test is used. A 1% inoculum of the filtered sample to be tested is added to a vitality test on the mixed culture and the acidity produced compared with that produced in a control test on the same culture. When phage is present in the sample, the vitality of the culture will be markedly reduced.

Laboratory Testing of Factory Samples.

Although bacteriophage has been found to be the most common cause of slow vats in Queensland cheese factories, it is not the only cause. Consequently, before bacteriophage can be correctly blamed for a vat stoppage, laboratory verification of the presence of phage in sufficient titre must be forthcoming. The practice has been for factories experiencing slow vats to forward to the laboratory samples of both bulk starter and vat whey. Tests have then been conducted along the lines previously described to determine bacteriophage titres for the various starter strains. The bulk starter sample is necessary to determine whether the phage infection originated in the cheese factory or was present in the starter added to the vat. Experience in both laboratory and factory has shown that a starter culture may be clotted and still be phage infected. This happens particularly when the phage gains entrance after some initial starter growth has taken place and sufficient acidity has developed to promote clotting. In such a case, the clotted culture represents a trap, for although it appears quite normal, it will not develop satisfactorily in the cheese vat.

Very large numbers of starter and whey samples have been tested in the laboratory, and whereas almost all samples of whey have proved positive for phage, few of the samples of bulk starter have been found to be infected. It has been apparent that slow vats seldom result from phage-infected starter, the cause almost always being infection from within the factory.

In addition to samples received in connection with slow vats, other samples (unclotted starter or starter milk) have been examined following starter failures prior to manufacture. Usually phage has been found to be present and to be the cause of failure to clot. Sometimes, however, the cause has been failure to inoculate, and on other occasions a sudden cold night has caused a thin culture which usually clots by the time the sample reaches the laboratory.

SOURCES OF BACTERIOPHAGE INFECTION.

It has been stated in the preliminary discussion on bacteriophage that it is not known where bacteriophages come from but that they are found wherever their host bacteria are cultivated regularly. There is some reason for believing that an ultimate source of them does not exist and that they are ubiquitous in the same way as bacteria and other micro-organisms.

Seasonal Incidence of Bacteriophage.

It will be of interest to consider here the noticeable seasonal occurrence of slow vats due to bacteriophage. Observations made in Queensland cheese factories have revealed that bacteriophages are not constantly present in any one factory; rather do they seem to come and go without any apparent explanation. However, there would appear to be a marked seasonal influence prevailing. Slow vats due to bacteriophage have been most common during the autumn and early winter months, March to June; then again during spring. Furthermore, phage attacks seem to accompany dull cloudy weather, and when the season holds dry, as in the long 1951 drought, bacteriophage failures are not common.

Such a seasonal trend has been noticed also by observant men in the cheese industry. The reasons why this should be so are not clear and any possible explanation at this stage could be only a matter of conjecture. It seems probable, however, that two factors, sunlight and humidity, may play a part.

Bacteriophage Surveys.

Whenever a factory has experienced repeated starter failures or slow vats, a survey has been conducted at the factory to determine whether or not the failures are due to contamination by bacteriophage, and if so, where the infection is originating. In surveying, samples have been taken at all possible sources of infection and the samples tested against the starter or starters which have been used. Examinations have been made of factory milk supply, water supply, rennet, factory and starter room air by exposure of culture milk, swabs of factory equipment, whey, and hands and clothing of factory personnel. The surveys have yielded very valuable information and have shown that bacteriophage infection in the cheese vat can come from several

sources in the one factory. Where a factory has been experiencing repeated slow vats, phage for the starters in use is usually well distributed throughout the factory. The following sources of infection are listed:—

1. Equipment.
2. Whey.
3. Personnel.
4. Water and drainage.
5. Air.
6. Milk supply.
7. Rennet.

Bacteriophage Contamination from Equipment.

Swab tests have repeatedly revealed a general distribution of bacteriophage on cheese factory equipment, vats and open surface coolers being common sources. In fact, in very few instances has it been possible to swab cheese vats without finding traces of infection. This experience would suggest that contamination directly from equipment surfaces provides the greater part of the phage infection in the cheese vat of milk. It would appear that cheese vats and open surface coolers are difficult pieces of equipment to sterilize thoroughly and this no doubt is an important contributing factor. The remedy lies in adequate sterilization of equipment surfaces, a subject which will be dealt with under the heading of factory hygiene.

Leaking vats are a special menace. Only too frequently has it been found that a particular vat in a factory is prone to slowness. This slowness has often been traced to leaks in the vat lining, allowing whey to seep through into the casing; this whey being protected from vat sterilization procedures, then serves as a focus of phage contamination back into the vat. It is noteworthy that this source of trouble, so common with the old tinned steel vats, has become rather rare now that stainless steel vats with welded stainless seams have come into prominent use.

Bacteriophage in Cheese Factory Whey.

Cheese factory whey is actually or potentially a culture of bacteriophage. When viewed in this light, it is seen in its right perspective. In whey, there is a massive culture of the starter organism, on which can develop an immense phage population. Through the medium of whey, the phage can become widespread throughout the whole of the factory, its precincts and the waste disposal area.

It follows logically that too much care cannot be exercised in the handling and disposal of whey. It should not be allowed to splash about so as to unnecessarily spread infection, but should be disposed of with the utmost speed and efficiency.

It is not surprising that phages in a cheese factory appear first in the whey and that thereafter they are most readily obtainable from the whey, but their occurrence within a factory is governed by so many factors that they may appear and disappear in a very irregular manner. Such factors as rotation of starter strains, survival or persistence of the phage itself, factory hygiene and whey disposal play important parts.

Bacteriophage in Water Supplies.

One case is on record in Queensland where the factory water supply was found to carry appreciable quantities of phage. In this case, the factory drew a portion of its water supply from a dam which, during heavy rains, collected and held the surface water washing from the factory waste-disposal area. The waste-disposal area was heavily charged with phage, which was washed into the dam and thereby fed back into the factory, where it contaminated all equipment with which it came in contact.

The remedy in such an instance lies in the removal of the waste-disposal area to a site where surface waters cannot wash contamination back to the factory.

Under other circumstances, it is conceivable that bore or well waters could become phage infected if they are situated near to and below the factory whey tank or waste disposal area. Unsound bore casing may lead to pollution of the bore water from surface washings. In a similar way, wells may become infected.

Bacteriophage in Air.

Bacteriophage can become air-borne and because of the minute size of its particles can remain air-borne possibly for long periods. This feature makes its control much more difficult than it would otherwise be. It was early demonstrated in New Zealand that the mist from whey separators contains large quantities of bacteriophage which become air-borne when the mist evaporates. This has been confirmed in Queensland. It is also extremely likely that phage may become air-borne if earth impregnated with whey or infected water is dried to dust and becomes blown about. Some indirect proof of the air-borne nature of phage has been supplied by the utmost success which attends the use for bulk starter cans of water-seal lids with filtered air intakes.

However, the insidious nature of air-borne phage has probably been responsible for some unbalanced viewpoints sometimes held regarding it. The idea that cheese factory air is literally loaded with bacteriophage is quite wrong. In fact, in most Queensland cheese factories where whey separators are not in use, or where they are effectively sealed to prevent emission of mist, air-borne phage has not so far been demonstrated. When it has been necessary in the laboratory to produce a suspension of phage in air, this could be done only by atomising a liquid suspension: it could not be done by violent bubbling of air through a liquid suspension.

Only a few Queensland cheese factories have practised whey separation in the past, so it appears that in this State air-borne phage, while still a source to be reckoned with, is not the main source of phage infection.

Bacteriophage in Milk Received.

The whey from cheese vats may contain large quantities of phage, which, if the whey is not sufficiently heated, is carried back to the farms and may find its way into the milk supply.

Queensland legislation was introduced requiring all whey returned to farms in milk cans to be first heated to a temperature of at least 180°F., the object of such legislation being to prevent the spread of disease-producing organisms as well as to improve quality. It was also later thought that such measures prevented the return of phage to the farm.

However, recent investigational work has shown that despite large amounts of phage being sent back to farms in unheated whey, very little was returned to the factory in the milk supply. In addition, it has been revealed that there is no connection between the phages returned to farms in whey and the frequency with which they may be present in the milk. Bacteriophage has been found in milk on a number of occasions, but the quantities have always been very small. As a result, it is now considered that the amount of phage in milk is too small, and its incidence is too irregular, to warrant the costly heat treatment of whey for the purpose of destroying phage. Provided that the whey is from pasteurised milk, there is little likelihood of pathogenic organisms being transmitted. In either case, milk cans used for transporting whey must be thoroughly washed and sterilized on return from the factory. Several factories have discontinued the heating of whey without any noticeable increase in the number of phage vats. It should be mentioned here that all these factories work single strain starters on a strict rotational system.

Bacteriophage in Rennet.

On two occasions phage has been found in cheese factory rennet in this State. On one of these occasions, the rennet was from a partly used keg, so there existed a possibility that the rennet had become contaminated while in the factory; on the other occasion, however, a new keg was opened to take the sample. This finding shows that it is possible to introduce phage into a cheese factory in the rennet supply. In the absence of any knowledge concerning the survival of phage in the stomach of calves fed with whey, or of its survival during the process of rennet extraction, it can only be surmised that rennet is a possible means of phage dissemination.

Bacteriophage on Personnel.

Emphasis has already been placed on starter contamination from personnel. During bacteriophage survey work in cheese factories, the hands of the operative performing the starter subculturing have invariably been found to carry phage; so have the aprons unless they have been changed before commencing starter propagation work. Swabs of the necks of mother culture flasks handled by operatives have also shown the presence of phage. In this regard, the practice in some factories of extinguishing flaming cotton-wool plugs by placing the cupped hand over them is to be condemned, since it frequently brings the fingers in contact with the neck of the flask, over which the starter must flow during inoculation of the bulk starter milk. It is safer to blow out the flame.

There is every reason to believe that contamination of the starter cultures from the operative's person, or as a result of irregular propagation techniques, constitutes the major means of culture contamination in this State. As a result of the work that has been done, it is thought to be even more important than contamination through infected air.

[TO BE CONTINUED.]

Horticultural Districts of Queensland.

9. The Wet Tropics.

S. E. STEPHENS, Horticulturist.

LIKE the dry tropical zone of North Queensland, the wet tropics embraces a large tract of country, much of which is closely settled but largely devoted to rural industries other than horticulture. Horticultural activities are therefore widely and somewhat thinly scattered over an extensive area.

The wet tropics includes the area of greatest rainfall in Australia, and totals of over 300 inches in 12 months have been recorded. The greater part of the area, however, experiences more moderate falls of between 80 inches and 140 inches, whilst fringing lands and odd pockets within the high rainfall belt receive only 50 inches to 60 inches. The district lies on the coastal plain and above the coastal ranges; it extends some 250 miles along the coast from Bambaroo to north of Cooktown, but nowhere extends inland for more than about 60 miles (Plate 106).

As the highest mountain chain in Queensland runs down the approximate centre of the district, no long river systems exist. Nevertheless, the Herbert, Tully, Johnstone and Barron Rivers, which rise above the coastal range and find their ways by extensive deviations through the range to the eastern coast, are no mean streams. The Burdekin river, probably the greatest river system in Queensland, taps the high rainfall area with its headwater streams and flows south on an inland course to enter the sea in the dry tropical zone. Streams rising on the eastern side of the coast range are short, steep, and numerous, carrying high water runoff following frequent downpours of from 12 to 18 inches in 24 hours.

Cairns is the principal city and leading port of the area; it has a population of approximately 18,000, and port facilities capable of handling vessels with draughts up to 28 feet. Other important towns are Ingham, Tully, Innisfail, Babinda, Gordonvale, Mossman and Cooktown on the coastal strip, and Mareeba, Atherton, Malanda, Herberton and Ravenshoe on the highlands. Other ports in the district are Lucinda Point, Mourilyan Harbour, Port Douglas and Cooktown.

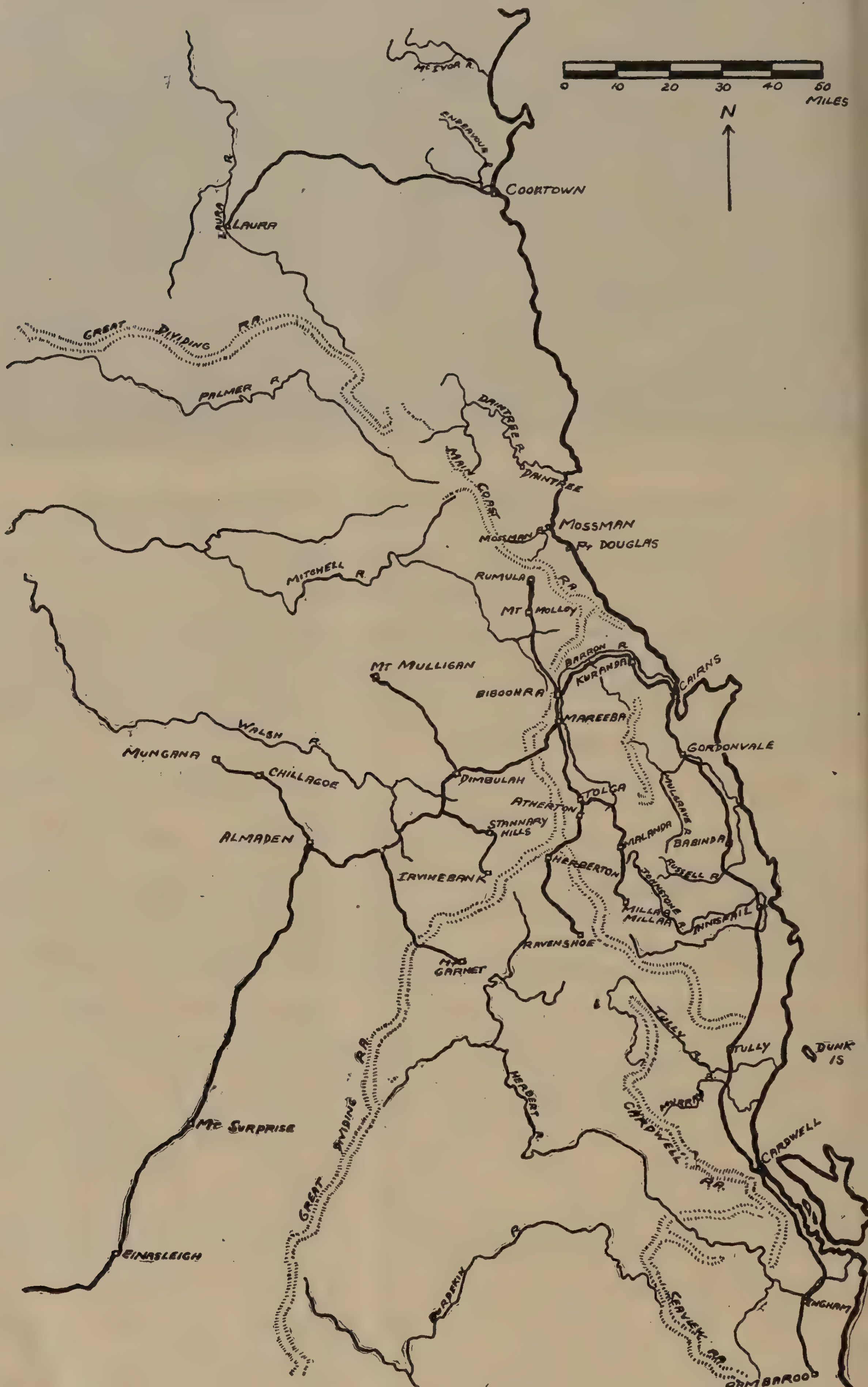

Plate 106.

Sketch Map of the Wet Tropics.

CENTRES OF PRODUCTION.

In the coastal lands, sugar cane growing is the most important ural industry and it monopolises the greater part of the arable land lose to centres of population. Horticultural activities are scattered hrough the sugar areas on odd pieces of land not assigned to cane r unsuitable for that crop because of their size, unevenness or inaccessi-ility. In addition, horticultural centres exist in the Cardwell-Murray River, Clump Point, East Palmerston, Daintree, Barron River, Herberton and Kaban areas.

The Cardwell-Murray River centre is devoted chiefly to orange nd mandarin growing with bananas as a secondary crop. At Clump Point, which is on the coast opposite Dunk Island, the principal crops re bananas and pineapples. In earlier times, coconuts and coffee vere also grown extensively there but both have been neglected in ecent years, although many of the coconut plantations still exist. At East Palmerston, a dairying district, bananas and pineapples are now grown in conjunction with that industry. Daintree also is a lairying district with banana growing as a companion industry. Along he Barron River and its tributaries between Mareeba and Kuranda, he greater part of the vegetable industry of the district is centred. This area is mainly frost-free, and as it is outside the excessively wet zone, many vegetable crops can be grown during the greater part of he year. At Mareeba, vegetables and tobacco are companion indus-ries. Herberton is situated at an altitude of approximately 3,000 feet and its granite soils are satisfactory for the cultivation of grapes. Kaban is a growing centre of vegetable production during the wet season; as it is situated at a high elevation, its climate is relatively cool and such crops as cauliflower and rhubarb can be produced during the summer months.

HISTORICAL DEVELOPMENT.

Early development of the wet tropics more or less paralleled that of the dry tropics. In 1863, two years after the first North Queens-land settlement at Bowen, ports were established at Cardwell and Cooktown. Cardwell provided an outlet for the rich grazing lands on the headwaters of the Burdekin and Herbert Rivers and a meat-works was erected there to handle the stock output. With the development of the Hodgkinson and other mineral fields, this town became the administrative centre for the whole district. Within a few years, however, Port Douglas was opened as a nearer and more acces-sible port for the mineral fields. Later, when a railway was built over the coast range, Cairns became the principal port. Cooktown, which was once a thriving town and the port for the very rich Palmer goldfield, declined rapidly when large scale mining came to an end.

Exploration and development of the wet coastal portions of the district was carried out by sea from Cardwell. Settlement therefore took place mainly on the sea coast and along the coastal streams (Plate 107).

Sugar cane growing was one of the first industries established. In the early days, the assistance of a labour force recruited from the Pacific Islands and Chinese labour thrown idle by the decline of the goldfields did much to develop agriculture and horticulture in the area. The Chinese cleared the jungle and planted and harvested

bananas on leased land which ultimately reverted to the owner almost ready for ploughing and planting with cane. During the last decade of the nineteenth century and the first decade of the twentieth, banana production was sufficient to maintain a regular traffic of three coastal ships per week between Cairns and Sydney and Melbourne. At the peak of production annual exports exceeded one million bunches, equivalent to approximately 25,000 tons of fruit. The frequent and regular shipping connection with southern centres of population provided an outlet for other fruit crops, and oranges, mandarins and pineapples were all cultivated extensively about Cooktown, Cairns and Cardwell.

Plate 107.

A River Flat Farm. Note the tree-lined frontage; irrigation presents no difficulties.

The cessation of regular shipping services during the first world war completely destroyed the fruit industry, however, for the local demand was small and the rail link with the south was incomplete. Orchards in the Cairns district were destroyed and replaced by cane; at Cooktown and Cardwell they were simply abandoned. The banana industry, which then extended throughout the whole coastal belt from Cardwell to Cooktown, also collapsed. Subsequent efforts to resuscitate fruit growing as an industry have been hampered by distance from markets, high transport costs, and unstable markets.

The tableland areas of the district have developed broadly from mining to timber and then to agriculture, horticulture, or dairying. In the high rainfall section, dairying is now the main industry, with agriculture and horticulture as minor sidelines. In the medium

rainfall strip, agriculture is predominant, with an extensive maize belt and a smaller peanut industry near Atherton. With the aid of irrigation, the fringing areas with low rainfall have progressed rapidly and crops of tobacco and vegetables are grown on relatively small farms.

CLIMATE.

The wet tropics lie within the high summer rainfall area of the State, and receive up to three-quarters of the total annual fall in the summer months. During this period of the year, daily falls of 7 to 10 inches are not infrequent. High rains generally fall during the late summer and autumn, but spring and early summer are usually dry and most horticultural crops therefore require irrigation at these periods.

Temperature and humidity are moderately high during the summer, but as they do not vary greatly they are seldom oppressive. Monthly mean maximum temperatures at sea level are less than 90 deg. F., and at 2,500 feet altitude 85 deg. F. The monthly mean minimum temperatures at the same period of the year are 74 deg. F. on the coast and 63 deg. F. on the highlands. The mean temperature range during the summer is therefore only 16 deg. F. on the coast and 22 deg. F. at 2,500 feet.

In the winter, monthly mean maximum temperatures at sea level and at 2,500 feet altitude are respectively 78 deg. F. and 71 deg. F., whilst the mean minima at the same period are respectively 54 deg. F. and 50 deg. F.

In the coastal portion of the district, frosts are very rare and are not severe—the absolute minimum screen temperature of 34 deg. F. was recorded at Cardwell in July, 1932. On the highlands, however, frosts may occur each year at any time between the beginning of May and September. As periods of warmer weather may intervene between successive frosts, there is some risk of injury to tree and vine crops that may make new growth in a mild winter.

The prevailing wind is from the south-east and it blows steadily and strongly during a great part of the year. Northerly weather is usual during the storm season in late spring and early summer. This season is characterised by flat calms interspersed with light to moderate breezes from the north and occasional winds of gale force accompanying electrical storms.

Climatological data for Innisfail (representing the high rainfall coastal area), Cooktown (representing the lower rainfall coastal area), and Atherton (representing the moderate rainfall highland area) are set out in Table 1.

SOILS.

The cultivated soils of the district fall into four broad divisions, each of which supports large and diverse rural activities. They are the dark-red loams derived from basalt, the lighter red and brown soils derived from schists, the granitic sands and gravels, and the alluvials.

The dark-red volcanic soils cover a large part of the Atherton and Evelyn tablelands and the Innisfail district. Smaller areas of the same soil type occur at Clump Point, near Babinda, near Gordonvale, at Green Hills, and in the Cooktown locality at Shiptons Flat,

TABLE 1.

CLIMATOLOGICAL DATA FOR THE WET TROPICS.

—	Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sep.	Oct.	Nov.	Dec.
INNISFAIL (altitude 22 feet).												
Average rainfall (inches) . .	20·04	22·65	26·73	19·95	12·42	7·23	4·75	4·91	3·52	3·22	6·37	11·70
Mean maximum temperature (°F.)	87·8	87·1	85·4	82·9	79·5	76·6	75·5	77·2	80·3	83·5	85·8	87·7
Mean minimum temperature (°F.)	72·1	71·8	70·3	67·3	63·1	59·6	57·4	57·5	60·7	64·2	67·4	70·1
COOKTOWN (altitude 17 feet).												
Average rainfall (inches) . .	14·41	13·72	15·30	8·77	2·81	1·99	0·96	1·19	0·57	1·03	2·50	6·59
Mean maximum temperature (°F.)	88·8	88·4	86·5	84·7	81·9	79·6	78·8	80·1	82·5	85·4	87·6	89·1
Mean minimum temperature (°F.)	75·3	75·1	74·6	73·3	70·3	67·8	66·2	67·3	70·0	73·0	74·7	75·4
ATHERTON (altitude 2,466 feet).												
Average rainfall (inches) . .	11·83	10·69	8·72	4·24	2·26	1·65	1·09	0·89	0·73	0·92	2·47	7·30
Mean maximum temperature (°F.)	84·2	82·3	80·1	76·5	74·3	71·7	70·9	72·6	77·9	82·3	84·3	85·3
Mean minimum temperature (°F.)	64·8	64·6	62·9	59·3	54·5	51·4	50·2	49·7	53·3	56·3	60·5	63·4

and McIvor River. These soils are very deep and normally of good structure. Usually they are only moderately acid in reaction and reasonably fertile. The surface soil, however, has a tendency to dry out, and shallow rooted crops sometimes suffer in dry weather if irrigation facilities are not available to maintain moisture supplies.

The schist soils occur on the highland area east of the Barron River and on the coastal strip in parts of the Herbert River valley, the Tully River valley and foothills, the Mulgrave valley, the Barron valley, Mossman, Cape Tribulation and many other places. In fact, a large part of the foothill land is of schist origin. Typically, a schist soil is fine textured, usually rather lighter in colour than a basaltic soil, and often fairly shallow. It often contains unweathered fragments of the schistose rocks from which it was formed. It is acid in reaction, rather deficient in available plant foods, has a tendency to lose its organic matter quickly and become floury in texture, and dries out excessively during short periods of drought. With good farming, schist soils can be quite productive, but close attention to green manure cropping, fertilizing, and irrigation is necessary.

Granitic sands and gravels are found in the Herberton and Mareeba districts, and parts of the Ingham, Cardwell, Tully, Babinda, Gordonvale, Mossman, Daintree and Cooktown districts. These soils are formed by the weathering of the granite masses that comprise large sections of the mountain ranges through the area. In the natural state they often contain a good deal of accumulated organic matter in the surface layer, which imparts a dark colour. After the humus has been lost through cropping, the colour of the soil changes to white or yellow. Granitic sands are usually well drained but the coarser textured gravels tend to dry rapidly after the organic matter has been destroyed. They become very hot when exposed to the sun and this has a detrimental effect on the roots of crops that do not produce adequate shade.

Alluvial soils (Plate 108) cover a large part of the coastal flood plain and occur in isolated pockets along the various streams that intersect other portions of the district. These soils are somewhat variable in structure and composition, depending on their location in relation to the streams by which they have been laid down, and on the original source of the material from which they have been derived. Some are of very fine texture and tend to hold excessive amounts of water after rain, whilst others drain freely. It is usual, however, for alluvials to contain rich deposits of silt. In some locations, this is replenished at short intervals by fresh deposits over the land during floods. Such soils are very rich and highly productive but they are suitable mainly for annual crops that can be planted after flood dangers are past. Care is also necessary to secure the soil by cover crops during the flood season.

VEGETATION.

High rainfall, temperature and humidity encourage vigorous plant growth, and the greater part of the coastal plain as well as much of the highland area in the higher rainfall zone was originally clothed with dense rain forest. This consisted of a multiplicity of softwood tree species reaching 60 to 80 feet in height, a dense growth of under-shrubs up to about 20 feet high, and vigorous climbing vines that overspread the other vegetation. This rain forest or tropical jungle,

known locally as "scrub," contains much timber of high commercial value for building and cabinet purposes. Logging and milling, therefore, employ a large number of people in the district.

The rain forest builds up a heavy litter of fallen leaves, twigs and branches on the forest floor. This gives a high organic matter content in the soil and results in good yields from crops planted on the freshly cleared land.

Although rain forest may be found on most soil types, differences in its composition occur. The deep volcanic soils usually carry many large trees and little undergrowth, so walking through the forest presents no difficulty. Schist soils, on the other hand, have fewer large trees and more dense undergrowth. The alluvials usually carry very dense vegetation with much tangled undergrowth that is difficult to penetrate.

In those parts of the district where rainfall is somewhat lower, and in parts of the high rainfall region where soils tend to dry out, open forest consisting chiefly of species of *Eucalyptus* is characteristic Hardwood forest soils are not necessarily poor. Some are quite suitable for cropping provided the land can be irrigated as required to maintain the soil moisture. The quality of the timber is usually a reliable guide to the soil type. Trees of vigorous and upright growth are most often found on good soil, whilst stunted and crooked timber occupies shallow soils of low fertility.

Extensive areas of land on the coastal plain, as well as smaller pockets in elevated locations, are thickly covered with stunted and twisted tea-trees. Such land is invariably subject to waterlogging during several months of the year and the soil is either clay right to the surface or consists of a shallow sandy layer on impervious clay. No horticultural uses have yet been found for land of this type.

HORTICULTURAL CROPS.

Horticultural development has been closely associated with the settlement of the area from the earliest days, but the crops grown and the volume of production have fluctuated. As previously mentioned, the banana growing industry was of major importance at the turn of the century. Citrus fruits, pineapples, mangoes, papaws, passion fruit, litchis, granadillas and grapes have been grown in the past and still are grown to a greater or smaller extent on a commercial basis. Many of the lesser known tropical fruits such as mangosteen, five corner, cashew, the various *Eugenias,* rambutan, and others are grown in limited amounts. Such strictly tropical crops as coconuts, coffee, tea and vanilla have also been grown successfully.

Vegetable crops include the full range of temperate or European vegetables and in addition sundry tropical vegetables that withstand summer heat and high rainfall.

Banana.

Banana plantations (Plate 108) are confined almost exclusively to flat land but occasionally the lower slopes of ridges are utilised. Extensive planting is confined to the coastal strip. On the highlands, plantations are small and scattered in localities where the frost risk is

Plate 108.

A Banana Plantation on Alluvial Soil, Cairns District.

Plate 109.

A Banana Bunch. The crop thrives under wet tropical conditions.

slight. On the coastal plain, the risk of soil erosion on slopes makes the use of flat or nearly flat land almost imperative. Alluvial soils are most favoured for the crop, as the soil moisture is at a favourable level without irrigation during the greater part of the year. In some areas, such as Clump Point, where rainfall is well spread throughout the year, other soil types are planted with satisfactory results.

Ever since the earliest days of cultivation, the Cavendish variety (Plate 109) has been extensively grown. Its dwarf growth habit offers some measure of resistance to wind damage, which the taller growing varieties do not possess. Whatever the variety, however, the banana plantation is almost invariably destroyed should it lie in the path of one of the cyclones that occasionally cross the coastline. Plants that are not completely blown out or broken by cyclonic wind always have the root system so extensively ruptured that they die within a few weeks.

Gros Michel, Sugar and Lady Finger varieties were grown on a commercial scale in earlier years, but Panama disease in the plants, coupled with lower yield per acre and greater difficulties in growing and harvesting, have almost eliminated all three from commercial production. In recent years, plantings of the two tall growing sports of the Cavendish, namely Mons Mare and Williams' Hybrid, have increased. At the present time they are more favoured than the Cavendish, as they appear to be hardier and produce better fruit.

Planting on ploughed land, cultivation with machinery, and the use of fertilizers are now more widely practised than in the past. Irrigation, too, is being used by some growers.

Pineapple.

Pineapple production has been at a very low ebb for many years. The rough leaf variety is grown on a small scale in many parts of the area, chiefly for local markets. The smooth leaf variety was not favoured by local buyers and was seldom grown. The establishment of a cannery at Cairns, however, has awakened interest in the possibilities of the smooth leaf. Yields from small commercial areas in the district have exceeded 20 tons per acre and comparable crops (Plate 110) can be expected where modern methods of plantation management are practised on suitable soils in many parts of the coastal strip. Yields are considerably less with the rough leaf variety, due in part to the lower individual fruit weight and in part to the wide spacing adopted for that variety.

The area of land suitable for pineapple growing is very large, and even though much is already devoted to sugar cane, suitable areas are available in most parts of the district.

Citrus Fruits.

Citrus fruit trees are common in the tropical wet belt. Most householders have several trees in their gardens and in consequence the demand for the fruit on local markets is very limited. Centres of commercial production were established some 50 years ago at Cooktown, Cairns and Cardwell-Murray River. In the few remaining orchards at Cooktown, the Emperor mandarin is the most widely grown variety. Due to a peculiarity of the climate, this variety matures some weeks later than in other parts of the district.

Plate 110.

Smooth Leaf Pineapples in the Innisfail District. A plant crop with fruits averaging 5 lb. in weight.

The original orchards at Cairns were eradicated many years ago. Small plantings of recent date have been chiefly Late Valencia oranges for local sale at the end of the fruit season.

In the Cardwell district, orchards have been kept in production ever since the first plantings at the beginning of the century. Local markets from Townsville north absorb the greater part of the crop, but financial returns have seldom been attractive and the growers usually supplement their income from citrus by growing other crops or by obtaining employment outside their farms. Seedling oranges and seedling Emperor mandarins were most widely grown, but in recent years Joppa and Late Valencia oranges have largely replaced the seedling oranges. During 1951 a large part of the orange crop from this district was processed for juice. This outlet is likely to prove valuable in future and should absorb much of the disfigured fruit and thus regulate the fresh market supplies.

Papaw.

The papaw (Plate 111) is a common rain-forest plant in many parts of the coastal strip. Fruits of the jungle grown plants are often of good flavour but are small and lack colour.

As a cultivated fruit crop, the papaw is widely grown in all frost-free sections and is found in home gardens as frequently as are the citrus fruits. Few commercial plantations exist, but culture on a small scale, often as a companion crop with bananas, is common. Hermaphrodite types are most favoured but dioecious types are sometimes planted also. No special variety is now grown; the general practice of saving seed from open pollinated fruits in mixed plantings has tended to submerge varietal characteristics.

Plate 111.
A Papaw Plant. Papaws are frequently interplanted among bananas.

Under tropical conditions of climate the papaw plant tends to elongate rapidly. When the crop is field-planted in late spring or early summer, the plants grow tall and may reach eight feet or more before fruit setting takes place. The commercial life of these tall growing plants is short. Autumn planting, however, tends to restrict stem elongation and encourage low fruiting.

Passifloraceous Fruits.

The passifloraceous fruits include the purple passion fruit, the golden passion fruit, the bell apple and the large and small granadillas.

The purple passion fruit is a common rain-forest vine of the mountain slopes and tableland. Under these natural conditions it grows vigorously and fruits prolifically. Under cultivation it is more successful on the highlands than on the coastal plain.

The golden passion fruit is more vigorous and hardy than the purple variety. Its fruits are larger and slightly more acid than the purple, and the ripe skin colour is yellow. The plant flowers profusely, but fruit setting is often sparse unless hand pollination is practised.

The purple and golden passion fruits have been crossed in recent years and vines with the vigour and fruit size of the golden and wine coloured skin colour have been produced. However, the cross has not yet been fixed.

The bell apple is grown on a small scale around Cairns, where it is sometimes called the Singapore passion fruit.

The small-fruited granadilla used to be widely grown by Chinese gardeners in the Cairns and Innisfail districts. The plants are grown on an overhead horizontal frame or trellis supported on posts about seven feet clear of the ground and spaced 10 feet apart each way. These granadilla "sheds" were a feature of most Chinese market gardens, in which they often formed a covered walk leading from the garden entrance to the farm buildings. The small-fruited variety usually fruits freely and so is preferred to the large-fruited variety, which requires artificial pollination in most instances.

Fruit setting in all passifloraceous fruits is somewhat uncertain in the wet tropical zone and commercial production is therefore somewhat hazardous. However, the market is satisfactory if the crop can be produced.

Mango.

Many parts of the wet tropics are unsuitable for the mango. In all coastal parts of the district the tree grows vigorously, but in the areas of higher rainfall fruiting is rare.

The areas round Ingham, Cardwell, Cairns and Cooktown produce heavy fruit crops, but very few of the superior varieties are grown. The Common mango, which has good flavour but is exceedingly fibrous, accounts for the greater part of the production. In past years the bulk of the crop has been wasted, but during the 1951 season a considerable quantity was processed locally.

Litchi.

In subtropical and temperate parts of Australia the litchi is known only as the dried date-like fruit imported from China. The fresh fruit is grown, however, in this district. Seedling trees up to 30 feet high and with a spread of 40 feet are growing at Cairns and Mossman but their cropping habits are irregular. Marcotted trees produce the commercial crops and the varieties giving the best results are Kwai Mee and Wai Chee. The former ripens in November and early December and the latter during December and January. Marcotted trees are not readily available and any expansion of litchi growing must therefore be very slow.

Grape.

Grape growing (Plate 112) is restricted to the Herberton area, an elevated plateau on the drier fringe of the district. Winter conditions are scarcely sufficiently regular for proper dormancy in the vines, so the higher class European varieties do not thrive. Good results are obtained, however, with the hardier American varieties. Those most favoured are Improved Isabella, Ferdinand de Lesseps, Goethe and Wilder. Several plantings of Muscatels give irregular results due to the variable climate. Storm rains on the ripening fruit sometimes cause heavy losses. Local markets absorb all the crop and could handle a greater bulk, as the harvesting season is in advance of that in southern Queensland.

Coconut.

A number of small coconut plantations were established at various points along the coastal strip in the early years of the century. The palms grow well and produce satisfactorily but the areas are of insufficient size to warrant collection of the nuts and production of

copra. The demand for fresh nuts is limited but small quantities are sent to southern markets from time to time. By far the greater quantity is utilised on the plantations for stock food.

Plate 112.

Grapes in the Herberton District. The wire netting protects the fruit from birds.

Coffee.

Coffee was an important crop in the wet tropical area during the early years of this century. In 1900 there was a total of 420 acres planted to this crop in North Queensland, the main producing centres being Kuranda, Clump Point, and the Atherton Tableland. Frosts were responsible for destroying the industry in the highland areas, whilst on the coastal fringe shortage of harvesting labour defeated the growers. At the present time no commercial coffee plantations exist. The crop can be successfully grown in frost-free areas of the district, but any future development of the industry will be influenced by the economics of harvesting and processing.

Tea.

Tea (Plate 113) has not been grown as a commercial crop, but experimental plots in higher rainfall areas of the district have demonstrated that the crop will grow successfully and that tea of commercial quality can be produced. Those parts of the district where rainfall is well spread over the greater part of the year, and where temperature fluctuations between summer and winter are least, give best growth and the longest harvesting season. The commercial development of the crop depends upon mechanical harvesting methods.

Plate 113.
Tea Growing. Experiment plots at Bureau of Tropical Agriculture.

Vegetables.

Prior to World War 2, vegetable production in the wet tropics was restricted both in quantity and season of cropping. The demand that followed large troop concentrations in the district encouraged farmers to expand the area under vegetables and to extend the cropping season. It was then found that most vegetable crops could be grown in at least some part of the district during the whole year, and the far north is now more or less independent of vegetable supplies from other parts of the State.

The most consistent crop production is obtained along the Barron River between Mareeba and Kuranda, where the annual rainfall is about 40 inches and an elevation of about 1,200 feet gives an equable climate. Beans, tomatoes and cabbage are the main crops, but cauliflowers, carrots, beet, turnips, lettuce, pumpkins, and most other vegetables are also grown. Watermelons also are sown extensively for harvesting between October and January. Irrigation is used on all these farms and is essential for successful cropping over a long season.

On the Atherton Tableland, where there is some frost risk during winter and the summer rainfall is heavy, the season for vegetables is more restricted.

On the higher tableland in the Kaban area, summer and autumn cropping is practicable and even lettuce and cauliflowers can be produced there at that period of the year.

Vegetables on the coastal strip are almost entirely grown as winter and spring crops. As the spring season is almost invariably dry, irrigation is essential to maintain continuity of production.

The varieties planted vary to some extent in different parts of the district. This applies particularly to tomatoes and to a lesser extent to cabbage and lettuce, and is probably due to climatic conditions at the cropping period rather than to soil or other factors. Burwood Prize, Sioux, Red Cloud and Stokesdale tomatoes are satisfactory in different areas. Henderson's Succession and Utility are the most widely favoured cabbages. Imperial 847, Great Lakes and New York lettuce are grown in different seasons. Brown Beauty French bean, Red Cored Chantenay carrot and Early Phenomenal cauliflower are the usual varieties of these vegetables.

Plate 114.

The Long Bean. A useful green vegetable for summer in North Queensland.

Wong Bok Chinese cabbage, Gai Choy and Pak Choy are grown more extensively than spinach. Long beans (Plate 114) are substituted for French beans on the coastal strip during the summer months. Oriental cucumber is a vigorous variety resistant to mildew that has been developed by Chinese gardeners for summer growing.

PRODUCTION AND MARKETS.

The area under crop and the approximate production during 1950-51 are shown in Table 2. Export markets are not readily available on account of the great distance from large cities, high transport costs and wastage in transit. Local markets, under normal conditions, are

strictly limited by the small population. They are also subject to frequent price fluctuations, so there is little stability for a horticultural enterprise that depends upon local fresh markets for disposal of the produce.

Fortunately, a processing outlet has recently become available by the establishment of a cannery at Cairns and a freezing plant at Townsville. Stable prices for certain horticultural crops of specified grades supplied to these processing plants should do much to stimulate the development of horticulture in the district.

TABLE 2.

Acreage and Production in the Wet Tropics for 1950–51.

——	Acreage.	Production.
Fruit in Bearing—		
Bananas	238	24,225 bushels
Pineapples	61	7,659 bushels
Citrus	449	31,946 bushels
All other fruit	35	..
Fruit not yet Bearing ..	318	..
Vegetables	910	1,137 tons

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The Library Board of Queensland invites country people to make use of the resources of the Public Library of Queensland through its Country Extension Service. Books are available on a wide range of subjects, including accountancy, anthropology, architecture, auditing, aviation, biography, biology, boat-building, botany, carpentry, chemistry, cookery, drama, drawing, economics, education, engineering, farming, fruit-growing, furniture, gardening, geology, history, journalism, languages, model-making, motor vehicles, music, needlework, painting, philosophy, photography, physics, poetry, political science, psychology, radio, salesmanship, sheep and wool, sheet metal work, surveying, travel, welding, wood-carving and zoology.

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Those wishing to enrol as borrowers should obtain an application form from the Country Extension Service, Public Library, William Street, Brisbane.

TUBERCULOSIS-FREE CATTLE HERDS.

(AS AT 11th SEPTEMBER, 1952.)

Breed.	Owner's Name and Address of Stud.
Aberdeen Angus	The Scottish Australian Company Ltd., Texas Station, Texas F. H. Hutton, " Bingegang," Dingo
A.I.S...	F. B. Sullivan, " Fermanagh," Pittsworth D. Sullivan, " Bantry " Stud, Rossvale, *via* Pittsworth W. Henschell, " Yarranvale," Yarranlea Con. O'Sullivan, " Navillus Stud," Greenmount H. V. Littleton, " Wongalea Stud," Hillview, Crow's Nest J. Phillips and Sons, " Sunny View," Benair, via Kingaroy Sullivan Bros. " Valera " Stud, Pittsworth Reushle Bros., " Reubydale " Stud, Ravensbourne H. F. Marquardt, " Chelmsford " Stud, Wondai W. G. Marquardt, " Springlands," Wondai A. C. and C. R. Marquardt, " Cedar Valley," Wondai A. H. Sokoll, " Chelmsford," Wondai W. and A. G. Scott, " Welena," A.I.S. Stud, Blackbutt G. Sperling, "Kooravale" Stud, Kooralgin, via Cooyar
Ayrshire	L. Holmes, " Benbecula," Yarranlea J. N. Scott, " Auchen Eden," Camp Mountain " St. Christopher's and Iona " Studs, Brookfield Road, Brisbane E. Mathie and Son, "Ainslie" Ayrshire Stud, Maleny
Friesian	C. H. Naumann, " Yarrabine Stud," Yarraman
Guernsey	C. D. Holmes, " Springview," Yarraman
Jersey	J. S. McCarthy, " Glen Erin Jersey Stud," Greenmount J. F. Lau, " Rosallen Jersey Stud," Goombungee G. Harley, Hopewell, Kingaroy Toowoomba Mental Hospital, Willowburn Farm Home for Boys, Westbrook F. J. Cox and Sons, " Rosel " Stud, Crawford, Kingaroy Line R. J. Browne, Hill 60, Yangan P. J. L. Bygrave, " The Craigan Farm," Aspley A. Verrall and Sons, " Coleburn Stud," Walloon R. J. Crawford, " Inverlaw Jersey Stud," Inverlaw, Kingaroy P. H. F. Gregory, " Carlton," Rosevale, *via* Rosewood E. A. Matthews, " Yarradale," Yarraman A. L. Semgreen, " Tecoma," Coolabunia G. & V. Beattie, " Beauvern," Antigua, Maryborough L. E. Meier, " Ardath " Stud, Boonah A. M. and L. J. Noone, "Winbirra," Stud, Mt. Esk Pocket, Esk W. S. Conochie and Sons, "Brookland" Stud, Sherwood Road, Sherwood

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ANIMAL HEALTH

Leptospirosis in Cattle.

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and

G. C. KENNY (Inspector of Stock).

LEPTOSPIROSIS is an infectious disease affecting chiefly calves and to a less extent adult cattle. It has been known in calves in Queensland for many years under the names redwater of calves and ictero-haemoglobinuria of calves. In the acute form there is fever, anaemia, jaundice, and haemoglobinuria (that is, red or brownish urine due to the presence of blood pigment). In sub-acute and chronic cases the principal symptoms are nephritis (inflammation of the kidneys) and failure to thrive. The symptoms and post-mortem findings in acute leptospirosis are therefore very similar to those of tick fever (the common redwater or babesiosis), but from the earliest days it was recognised as a disease distinct from tick fever, because:—

(1) there were no tick fever organisms in the blood or kidney tissue;

(2) tick fever is uncommon in calves, and

(3) the disease occurred outside the tick-infested area of the State.

Investigations by the Department of outbreaks at Gympie in 1949 showed that the disease is caused by infection with bacteria called leptospira. The species known as *Leptospira pomona* is the only one found so far in cattle in Australia. The correct name for the disease is therefore leptospirosis, and use of this name avoids any possible confusion with tick fever (the common redwater) or with any other disease of cattle.

DISTRIBUTION.

From January, 1949, to June, 1951, 82 outbreaks of leptospirosis in cattle were recorded at Yeerongpilly (that is, were confirmed by laboratory tests). Other outbreaks in which a clinical diagnosis was made also occurred. As shown in Plate 115, outbreaks occurred in all the major dairying zones, except the Atherton Tableland, as well as at Clermont, Longreach and Muttaburra. The disease occurs also in New South Wales, Victoria and Western Australia.

Plate 115.

Distribution of 82 Confirmed Outbreaks of Bovine Leptospirosis in Queensland from January, 1949, to June, 1951. Each dot represents one infected herd.

The animals affected in 31 outbreaks in Queensland were:—

Calves only	20 outbreaks
Calves and cows	5 outbreaks
Cows only	6 outbreaks

These figures are considered representative of outbreaks as a whole.

ECONOMIC IMPORTANCE.

In many outbreaks half the young calves in a herd have died, and some of the survivors have had to be destroyed because they failed to thrive. Among adult cattle there have been some deaths, but more serious financial loss has resulted from loss of milk production—from either temporary reduction of yield or complete drying-off of all quarters. In some affected herds there have been many abortions.

In some outbreaks the disease was transmitted to human beings who had contact with the affected cattle.

SYMPTOMS.

It must be emphasised that considerable variation in the severity and the course of the disease has occurred in different outbreaks and even among different animals within the same herd. In general, calves 1-3 months of age are affected most severely and suffer the highest death rate; calves 6-12 months usually have a milder attack, but at times are affected just as severely as the younger calves. In cows, the incidence and the death rate are usually lower, but loss of weight and loss of milk production can be serious.

Calves.

The first symptoms are usually lassitude and a tendency to tire easily and breathe rapidly when driven. In a few hours, or perhaps a day or so, there is fever and the animal is anaemic and jaundiced (that is, the mouth and eye membranes are pale and bloodless with a yellowish tinge). Haemoglobinuria is usually present for 24-48 hours, but this may be overlooked. In fatal cases death usually occurs 1-7 days after the first appearance of symptoms, but some calves may die so suddenly that they are found dead without having been seen sick. Some calves recover without treatment but are often sick for many weeks. Others develop chronic infection of the kidneys and remain unthrifty and are eventually destroyed. It has been found, too, that some calves contract the disease (and become "carriers") without exhibiting any symptoms.

The duration of the disease in calves varies a great deal. Many calves recover in about six weeks, but others remain unthrifty for much longer periods.

Adult Cattle.

In a severe attack of leptospirosis in a cow there is usually fever (temperature commonly 103°-105° but sometimes up to 107°) accompanied by rapid breathing, jaundice, anaemia and haemoglobinuria and terminating sometimes in death after 2-4 days. It must be stated again, however, that there is great variation from this typical picture. Milder cases may show only fever, loss of weight and some stiffness of muscles. Again, there may be only reduced milk yield, rough coat and normal temperature. Red urine may be passed on only one or two occasions and so is often not noticed.

When milking cows suffer an acute attack there is usually a sudden reduction in milk production. A cow that produced normally at the previous milking may produce only a little milk, which is usually curdy or watery or bloodstained; or the quarter may be hard and contain only a little blood; or again the udder may be soft and pendulous, as in a dry cow. Bloodstained milk is usually present for only the first day or two.

Most affected cows come back into production in about two weeks, although production is usually never as good as before the sickness. Some cows go dry after an acute attack.

Affected animals at times lose weight rapidly, and if the attack is severe, recovery is prolonged. In some affected herds many cows abort.

In some herds over 50% of the cows have been affected, while in other herds less than 5% have been sick. Mortality among adult cattle is not high, but it is evident that the economic loss can be heavy.

POST-MORTEM FINDINGS.

Acute fatal cases in either calves or cows almost always show anaemia, jaundice and haemoglobinuria (that is, pale watery blood, yellow discoloration of fat and other tissues and red or brown urine). The kidneys usually show abundant small haemorrhages. The spleen is sometimes soft and swollen, but never as much as in tick fever. The bile is usually thick.

In chronic cases that have been sick and unthrifty for a fortnight or more the most prominent abnormality is in the kidneys, which are usually swollen and scarred and exude fluid when cut.

DIAGNOSIS.

The symptoms and post-mortem findings in acute leptospirosis are similar to those of tick fever. As sickness due to tick fever is rare in young animals, a diagnosis of leptospirosis in calves showing fever, anaemia, jaundice and haemoglobinuria is usually correct.

In adult cattle, on the other hand, the close similarity to tick fever presents difficulties. The symptoms of tick fever and acute leptospirosis are very similar (or almost identical), but points that can be considered in an attempt to differentiate the two diseases are as follows:—

(1) Abortion is common in leptospirosis, but it is not a feature of all outbreaks; and furthermore other diseases (for example, brucellosis and vibriosis) can cause abortion.

(2) In leptospirosis milk secretion is usually reduced to a small amount of abnormal fluid.

(3) In herds affected with leptospirosis the disease usually—but not always—attacks calves as well as adult cattle.

(4) Leptospirosis does not respond to treatment with the drugs specified for tick fever—namely, Acaprin (Bayer), Piroparv (B.W. & Co.), Pirevan (Evans), Phenamidine (M. & B.) or Babesan (I.C.I.).

(5) Among adult cattle the mortality from leptospirosis is low whereas the mortality from tick fever is high (if treatment is not given). In calves the situation is reversed—that is, mortality from leptospirosis is high whereas mortality from tick fever is low.

Mild cases of leptospirosis in cows are not easy to distinguish from, and in fact have sometimes been mistaken for, three-day sickness or an unusual form of mastitis.

It is always wise, therefore, to consult the local veterinary officer or inspector of stock to make sure of the diagnosis, particularly in adult cattle, and to obtain advice on the correct treatment and preventive measures.

SPECIMENS FOR LABORATORY EXAMINATION.

The presence of leptospirosis can be detected by several different laboratory tests (for example, microscopic examinations, agglutination tests, guinea pig inoculations, &c.). However, leptospira are delicate

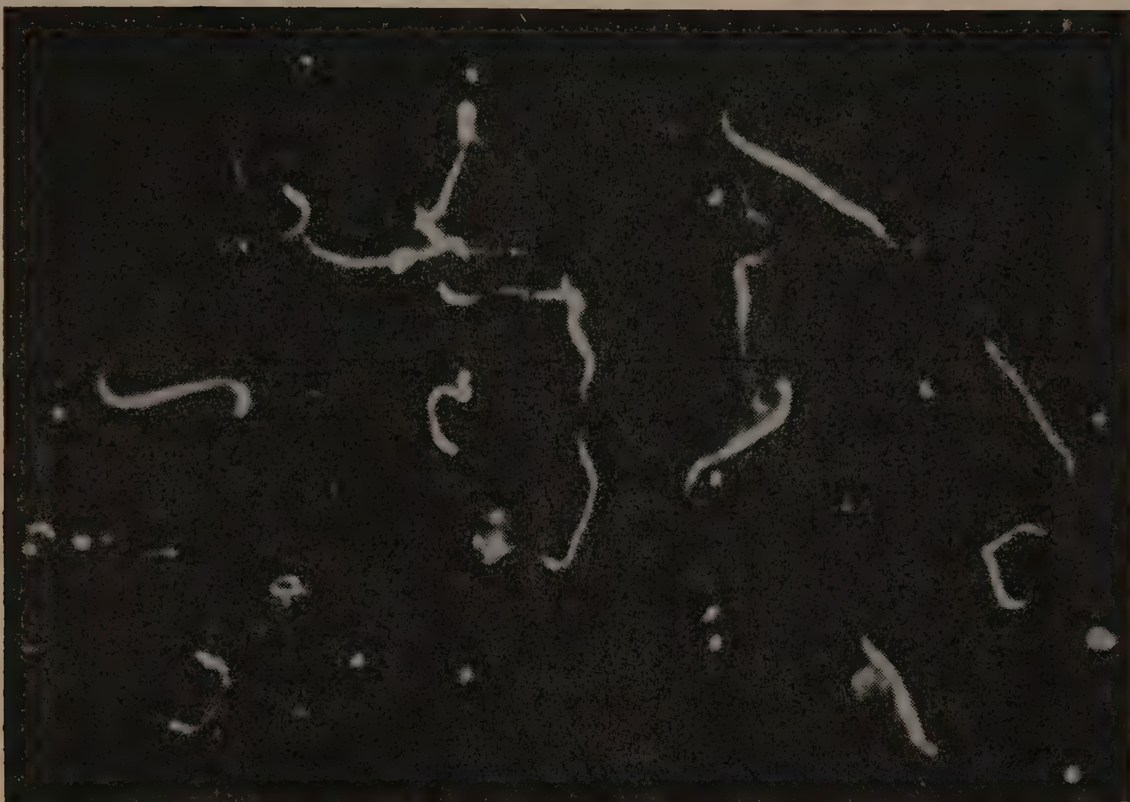

Plate 116.

Leptospira in Calf Urine, Magnified Approximately 1,600 Times. (Photo. by Mr. R. K. Keith, C.S.I.R.O., Yeerongpilly.)

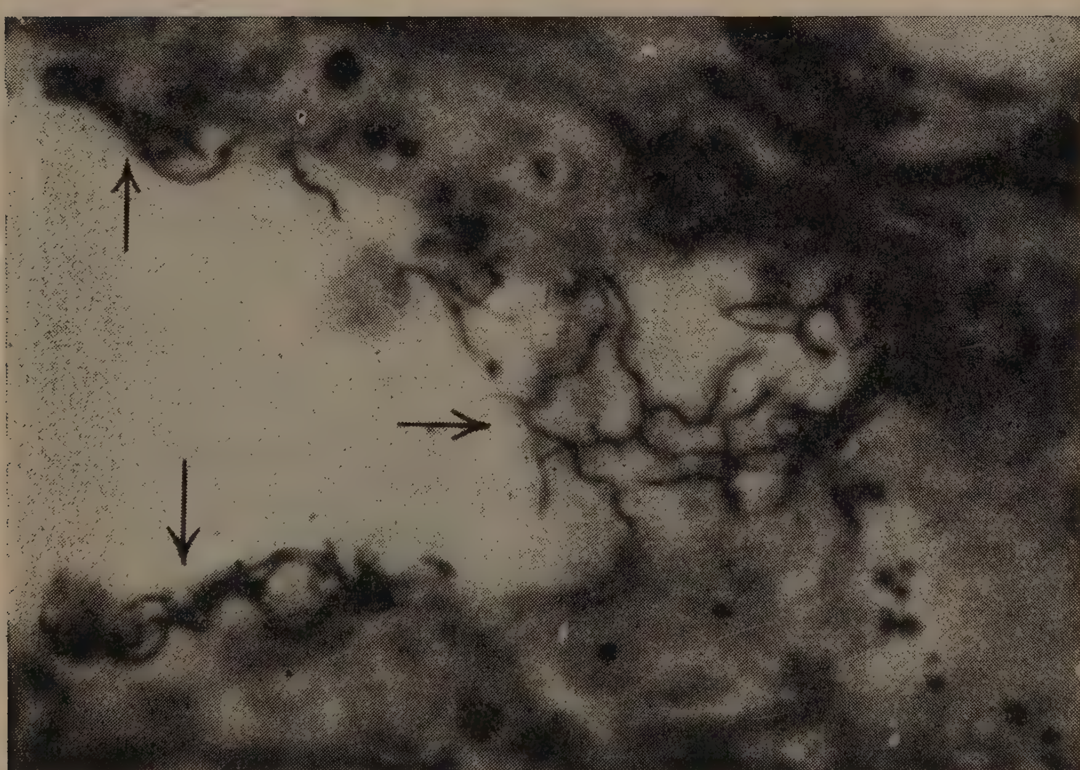

Plate 117.

Leptospira in the Kidney of a Calf. The organisms, stained black, are indicated by arrows. Magnified 2,500 times. (Photo. by Mr. R. K. Keith, C.S.I.R.O., Yeerongpilly.)

organisms sometimes not easily detected even in heavily infected specimens. It is therefore necessary that the appropriate specimens should be collected and sent to the laboratory in the proper form. Farmers who suspect the presence of the disease in their herds should therefore consult their local veterinarian or inspector of stock in order to make the best use of the available laboratory tests.

If a Departmental officer or veterinary surgeon is not available, farmers themselves could collect and send to the laboratory samples of urine and blood serum. About one ounce of urine preserved with about six drops of commercial formalin is required. Blood (20-30 c.c.) can be collected from the jugular vein and submitted without preservative in the same manner as samples for the agglutination test for brucellosis.

The tests on urine and blood will detect animals that have recovered from or are carriers of leptospirosis, but they do *not* detect animals in the acute stage of the disease. Thus, samples should be taken from several animals—six or more, including some that are recovering —if the results are to be of value.

It should be noted, too, that handling and collecting specimens from animals affected with leptospirosis is a decided risk unless the persons concerned wear rubber gloves and wash and disinfect their hands properly.

TREATMENT.

Sulphamezathine and Sulphamerazine.—These drugs appeared beneficial in some outbreaks where sick animals were detected early and dosed heavily (1 gram per 10 lb. liveweight), but they were disappointing in others.

Penicillin.—The results of treatment with penicillin (200,000 to 500,000 units per 100 lb. liveweight) injected deep into the muscles have been sometimes good and at other times disappointing. The treatment has usually relieved the acute fever, but treated animals may continue to pass leptospira in the urine for many weeks after they appear to have recovered (that is, they remain carriers of the disease).

Streptomycin.—This has been used on only a few calves. It seems to be the most promising treatment, especially as the treated calves do not pass leptospira in their urine and are therefore not carriers. The recommended treatment is 0·5 gram per 100 lb. liveweight injected intramuscularly (deep into the rump muscles) each day for two or three days.

Aureomycin.—Experiments on dogs and laboratory animals have shown that this is better than any of the above drugs for treating leptospirosis in these animals, but no information is available yet on the efficiency of aureomycin in leptospirosis of cattle.

The treatment recommended at the present time is therefore streptomycin. If this drug is not readily available, then combined simultaneous treatment with penicillin and sulphamezathine (or sulphamerazine) should be given. Treatment should be given daily for three or four days or until temperature and appetite have been restored to normal for 24 hours.

As with any treatment, it is important that the sick animals be detected in the early stages of the disease. The sick calves should of course be well cared for in a separate pen or yard, where they will not be disturbed by healthy ones.

PREVENTION.

Leptospira are passed out in the urine of cows and calves up to three months or more after the first appearance of symptoms. Hence, the urine of recovered and in-contact animals is a prolific source of infection.

Plate 118.

Calves Kept With Pigs May Contract Leptospirosis. Pigs pass enormous numbers of leptospira in their urine, although they usually show no signs of sickness.

Pigs are often carriers of the leptospira that causes disease in cattle (namely, *Leptospira pomona*). Infected pigs usually show no signs of sickness, but they pass enormous numbers of leptospira in their urine for periods up to a year or more. Thus, the first step in preventing leptospirosis among cattle is to protect them from exposure to pig urine or to any drainage or other materials likely to be contaminated with pig urine. There is ample evidence, in fact, that dairy herds have become infected with leptospirosis by purchased pigs, particularly pigs from saleyards.

Outbreaks have also occurred among cattle that had no contact with pigs, and in these herds the disease appears to have been introduced by carrier cows or calves purchased from other farms or from saleyards.

Plate 119.

The Sucking Habit of Calves Exposes Them to Infection With Leptospira from the Urine of Carrier Calves.

Leptospira are quickly destroyed by drying, but they can survive for long periods in neutral or slightly alkaline water or mud. It is therefore likely that many cattle contract the disease as a result of mud or water contaminated with urine coming in contact with their mouths or nostrils or with slight cuts and scratches on the skin. Related to this is the fact that outbreaks are more common and more severe during the wet season. However, they do occur at all seasons of the year and sometimes even on high, well-drained farms.

The habit that some calves have of sucking each other after feeding provides ample opportunity for direct transfer of infection from the urine of carrier calves to the mouth or nostrils of susceptible calves.

There is no effective vaccine for leptospirosis in cattle. The preventive measures that are recommended are:—

(1) Avoid wet or muddy conditions about yards, lanes or pastures.

(2) Keep pigs strictly separated from cattle.

(3) If pigs must be bought, then secure them from farms where the cattle are known to be healthy; pigs or calves or cows bought in saleyards can introduce leptospirosis into a healthy herd.

(4) When the disease appears in a herd, rear all calves born subsequently in strict isolation from the *whole* of the affected group (there are certain to be some carriers among the latter).

(5) If the disease appears in calves, keep them strictly isolated from the adult herd.

It seems that it should be feasible to eliminate leptospirosis from an infected farm by using blood serum and urine tests to detect the carriers among both cattle and pigs.

TRANSMISSION OF BOVINE LEPTOSPIROSIS TO MAN.

Leptospira pomona, the cause of bovine leptospirosis in Queensland, is transmissible to man, and in fact was first discovered as a cause of disease (coastal fever) among dairy farmers in the Pomona district. Cases of human leptospirosis have occurred on many of the farms on which bovine leptospirosis has been diagnosed during the past three years. Rubber gloves should therefore be worn at all times when examining affected animals. The organism is quickly destroyed by reliable disinfectants, and these should be used when ever necessary. Fortunately, no fatal human infections have been recorded in Australia.

QUEENSLAND POCKET YEAR BOOK, 1952.

Pending publication of the Queensland Year Book, 1952, the Government Statistician has issued the Queensland Pocket Year Book, 1952. This publication contains condensed statistical information on a wide variety of subjects and is a very handy reference book.

Copies may be obtained free from the Government Statistician, Treasury Building, George Street, Brisbane.

PLANT PROTECTION

Apple Pest Control in the Granite Belt.

A. W. S. MAY, Entomologist, Science Branch.

THOUGH many pests are associated with apples in the Stanthorpe area, those likely to be encountered each season are codling moth, light brown apple moth, mites, woolly aphid, and fruit fly. These destroy fruit, damage foliage or retard growth and specific measures for their control must be applied if orchardists are to obtain profitable yields.

Successful control of pests in apples depends mainly upon effective insecticides, thorough spraying and the timing of spray applications. For correct timing it is essential that growers recognise the several pests and have some knowledge of their seasonal behaviour.

A brief account of each major pest and the relative merits of measures that can be employed against them should assist growers in combating pests in their orchards. This information is necessary when planning a detailed seasonal control programme.

CODLING MOTH.

The larvae of this moth* enter the fruit and tunnel to and feed mainly upon the developing seeds and surrounding tissues. Damaged fruit usually fall from the tree.

Each spring the pest commences its activity with moth emergence from cocoons spun by overwintering larvae located under bark, in crevices on the tree, amongst refuse in the orchard, or amongst cases and packing material in or near the packing shed. The moths deposit eggs singly on the trees and these give rise to the first summer generation of grubs, which attack the newly formed crop. Development is complete by early summer, cocoons are spun, and the moths again emerge in midsummer to give rise to the second summer generation. No exact time can be given for this emergence as it depends to some extent on weather conditions. It may occur between late December and early February, although more usually in early January.

As sprays are applied to prevent grubs entering the fruit, a knowledge of when these two periods of major moth activity occur is an important factor in successful codling moth control.

Traps baited with a suitable lure can be used to attract moths, and the numbers caught at regular intervals provide means of gauging their activity throughout the season. For many years the Department has maintained traps for this purpose and has advised growers, by means of spray notices, of the most appropriate times for spray applications. Though serving as a guide, such information should be

* *Cydia pomonella* (L.).

applied according to the requirements in each orchard. Moth populations vary from orchard to orchard, depending on the efficacy of control measures applied in the previous season. Thus, more accurate information on the necessity of spray application in each orchard would be possible only if each grower maintained his own traps. Information on the use of lure traps can be obtained from Departmental officers at Stanthorpe and Toowoomba.

Plate 120.

Codling Moth Larvae Tunnelling in Fruit.

Many sprays or spray combinations are used by orchardists for codling moth control, but 0·1% DDT, applied during periods of major pest activity, has proved the most effective. Other insecticides should be used when populations are low to avoid additional applications of DDT and its attendant stimulation of mite and woolly aphid populations.

LIGHT BROWN APPLE MOTH.

Though closely allied to the codling moth, this insect* has different habits. It attacks a wide range of hosts, including apples, pears, grapes, apricots, plums and lupins. The last-mentioned host serves as an important source of food during the autumn and winter months and can be responsible for the presence of an appreciable pest population early in the ensuing fruit season.

Two or more generations of the pest occur during the growing period, the moths of the first commencing to emerge by early summer. Subsequent generations overlap and extend throughout late summer and autumn. Thus, moths may be present on orchards from late October onwards; they are most prevalent during the summer months.

* *Tortrix postvittana* (Walk.).

Plate 121.
Light Brown Apple Moth Damage to Fruit. Note that the injury is superficial.

Infestations in apples usually commence following egglaying on the younger leaves of leaders and terminal growth. The newly hatched grubs feed on the tissues, and spin leaves together to provide shelter. Later, as populations increase, feeding becomes more general and some fruit damage may occur. When fruit are attacked, the grubs gouge out areas of skin and underlying tissues beneath touching leaves or between adjacent fruits. Feeding is confined usually to the surface tissues, and burrowing into fruit is rare.

Though of less importance than codling moth, the light brown apple moth may cause considerable damage in certain seasons. The control of this pest is not a difficult problem and insecticide should be applied soon after larval damage becomes evident in the new growth. DDT sprays for codling moth control will check this pest, but these applications do not continue throughout the period when it is most active. Lead arsenate will prove of more benefit against the light brown apple moth.

MITES.

Mite damage occurs chiefly on the leaves, though fruit injury may result when large populations are present. These pests* feed by piercing the surface tissues and extracting sap from the underlying cells. The first symptoms of mite damage invariably occur in the older leaves both inside and towards the base of the tree. The normal green colour of the leaf is destroyed in the vicinity of each feeding puncture and the result is a yellow mottling of the foliage. When injury is severe, the entire leaf presents a yellowish-green colour. With the more susceptible varieties, Delicious and Winesap, severely injured leaves eventually redden and areas of tissue may die. Leaf shedding is not uncommon, and growth may be arrested. When mites are numerous, damage to the fruit of red apple varieties prevents normal colouring.

* *Tetranychus urticae* Koch; *Bryobia praetiosa* Koch; and an unidentified Eriophyid.

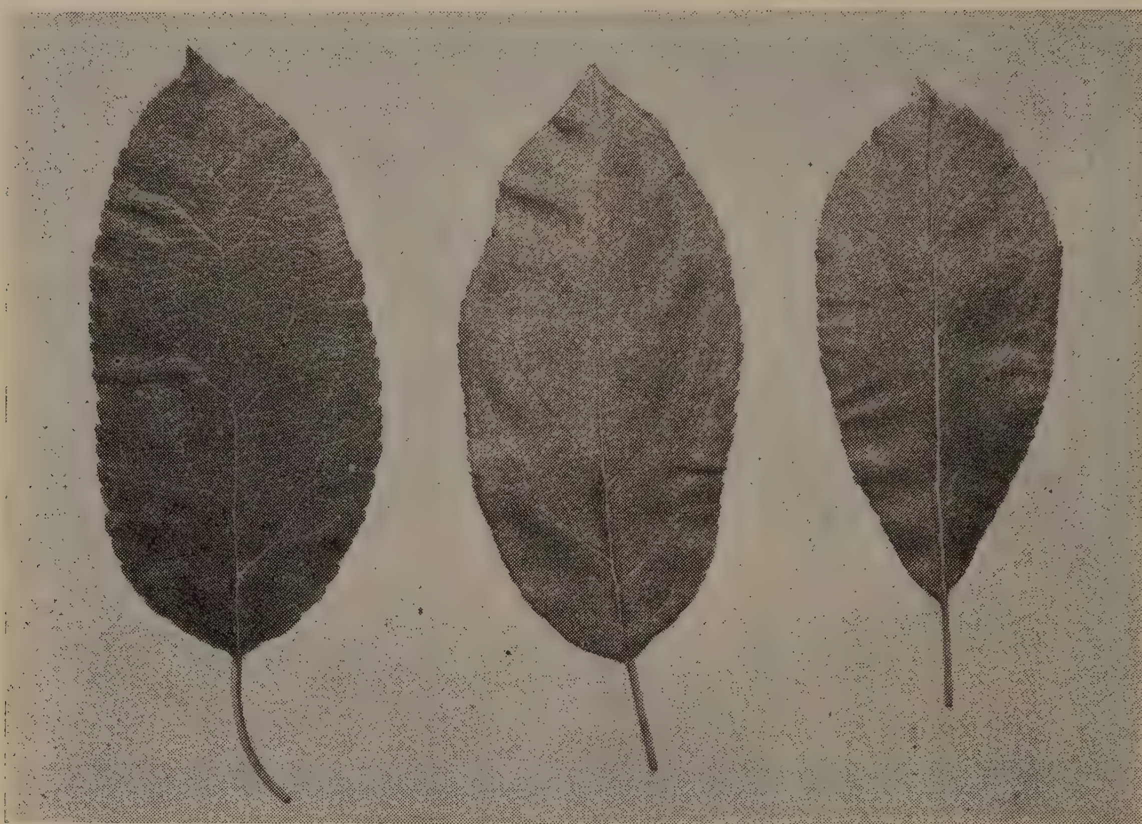

Plate 122.
Mite Injury. Left, normal leaf; centre and right, damaged leaves.

Three mites are commonly associated with apples. Two of these, namely Bryobia and an Eriophyid, are chiefly pests of deciduous fruit trees and overwinter in the egg stage on the apple tree. Egg hatching occurs in spring, when the mites crawl to the foliage and commence feeding. Populations reach a peak by midsummer. During autumn, numbers wane and the overwintering eggs are laid on the spurs and branches.

Red spider,* on the other hand, does not pass the winter in the egg stage and can feed on a wide range of plants. It is rarely prevalent on the trees until early summer, but once DDT is applied its numbers increase rapidly. The peak of activity occurs in late summer and early autumn. It is this mite that causes most of the injury each summer in orchards where DDT is used for codling moth control.

Mites breed rapidly during early summer and growers seldom can determine the prevalence of the pests before damage has occurred. Preventive treatments, therefore, should be applied before populations get out of hand; also, to be effective, miticides must be applied thoroughly.

Where dormant or semi-dormant oil sprays are used, the Bryobia and Eriophyid mites are seldom of importance during the following summer. Such sprays have little effect against red spider and summer treatment is necessary for control of this pest. These summer sprays should be applied before mite populations are large, preferably between early November and mid-December. Survivors of the other two mites from the winter oil sprays will also be checked by these summer treatments. One spraying is seldom sufficient and two closely spaced

* *Tetranychus urticae* Koch.

sprays should be applied. Many insecticides are used against mites, but E.605 (parathion) has been found most effective against all three species, and particularly against red spider. Sulphur sprays are less effective against this pest.

Plate 123.

Twig and Spur Galling Caused by Woolly Aphid.

WOOLLY APHID.

Woolly aphid* is not of general importance in the Stanthorpe district, but it may become a pest in certain seasons and require specific attention only in some orchards. It overwinters on the tree and colonies may be found on the spurs and on old pruning cuts in early spring. Under favourable conditions numbers *rapidly* increase and the pest spreads to new growth and causes a characteristic galling of stems. If populations are large, growth may be checked, and sticky secretions from the aphids cover fruit and branches. Sooty mould develops rapidly on this secretion and lowers fruit value.

* *Eriosoma lanigerum* (Hausm.).

The introduced wasp* parasite does not check populations before late summer and sprays are required to prevent damage to the new season's growth. Applications of winter oils and E.605 in the early summer for mite control usually check woolly aphid. Other summer sprays, such as nicotine sulphate and Hexone, may be used specifically against this pest.

FRUIT FLY.

Since the general and widespread use of DDT for codling moth control, together with suitable harvesting arrangements, the importance of this insect† as a pest of apples, has lessened considerably. In years that favour fly development, however, losses may occur to early and mid-season varieties on orchards where DDT has not been used during the summer months. Furthermore, the likelihood of damage by this pest increases in late summer, after DDT cover spray applications for codling moth control have ceased. Growers should be prepared, therefore, to apply remedial measures against this pest for the protection of late maturing varieties.

No fixed rule can be laid down concerning the possibility of fruit fly attack, as populations will differ greatly from orchard to orchard. The use of lure traps before varieties mature will provide growers with definite information on the need for preventive spraying.

DDT sprays, applied soon after fly activity has been demonstrated by trapping, will minimise damage by this pest. A partial cover spray of 0·2% concentration can be used, although a 0·1% spray will suffice when populations are small, or when used jointly for codling moth control.

SEASONAL SPRAY PROGRAMME.

The proper timing of sprays is an important aspect of pest control in apple orchards. Each spray has its special function but can be applied in combination with other materials for wider benefits, including reduced spraying costs. The adoption of a seasonal spraying programme provides for the control of each pest at a time when the best results can be expected. It cannot be too strongly emphasised, however, that in addition to applying the correct spray at the appropriate time, every consideration must be given to methods of spray application. Adequate spray pressure and complete coverage are desirable against all pests and are essential against mites, woolly aphid, and the light-brown apple moth.

It is impracticable to draw up a comprehensive and entirely effective orchard spraying programme to satisfy requirements on all orchards. Pest populations, spraying machinery and the standard of spray application vary considerably and the orchardist must regulate his spray programme accordingly.

Codling moth control should form the basis of all programmes, for this pest will continue to cause fruit losses if spraying is neglected. Thus DDT is recommended for the early November spray and again to destroy progeny of the second generation in January.

The following spray programme will serve as a guide and, with minor modifications, can be adopted to suit conditions in most Stanthorpe apple orchards.

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* *Aphelinus mali* (Hald.).

† *Strumeta tryoni* (Frogg.).

APPLE PEST SPRAYING PROGRAMME.

July to September.

Dormant or Semi-dormant Periods.

Use: *either Dormant oil—July or early August.*

or *Semi-dormant oil* plus *lime sulphur* at *green tip—approximately mid-September.*

Either spray will prove effective against the overwintering stages of mites and woolly aphid. These also control the San José scale* should it be troublesome.

October.

Calyx Spray.

Should moth populations be small this spray need not be applied.

Use: *either* Lead arsenate; white oil (3 lb.; 2½ pints; 100 gal.).

or Lead arsenate; zinc sulphate; hydrated lime; white oil (3 lb.; 1 lb.; 2 lb.; 2½ pints; 100 gal.).

or DDT (0·1%).

This spray is applied after the majority of petals has fallen but before the calyces are closed.

Early November.

(Approximately two weeks after time for calyx spray.)

This period is important for codling moth control.

Use: *DDT* (0·1%)—applied approximately one week after the peak of moth activity.

Alternative sprays, such as lead arsenate, nicotine sulphate—white oil and other combinations, cannot be recommended as substitutes for DDT if moths are prevalent.

Late November.

(Approximately three weeks after early November spray.)

Joint control of codling moth and the light-brown apple moth can be achieved at this time. Applications for mite and woolly aphid control also commence in this period.

Use: *A combination spray containing DDT, lead arsenate and E.* 605 to control all pests listed above.

Should codling moth populations be small, the DDT may be dispensed with in the spray. Complete tree coverage is essential for maximum benefit.

Mid-December.

If appropriate measures have been taken for codling moth and light-brown apple moth in early and late November, further sprays against these pests should not be required at this stage.

A further spray for mite control is recommended.

E. 605 will give the most effective results and should be applied not later than three weeks after the combination spray in late November. Lead arsenate may be added to this spray if light-brown apple moth is active.

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* ***Quadraspidiotus perniciosus*** (Comstock.).

Early to Mid-January.

Codling moth activity can be expected in this period.

Use: *DDT* (0·1%).

Timing of spray application will depend on moth activity recorded by trapping, and should take place approximately one week after the peak of moth activity.

Control measures against mites and woolly aphid should not be required if the appropriate sprays have been applied in early summer against these pests.

Late January–Early February.

Approximately three weeks after the early or mid-January DDT spray, a further spray is required to check light-brown apple moth and codling moth activity in late summer.

Use: *A combination spray of DDT* (0·1%) *and lead arsenate* (3 *lb.*–100 *gal.*), the DDT being added if codling moth is still active. To avoid undesirable insecticide residues it may be necessary to use only white oil—nicotine sulphate (1 1/3 gal. white oil; 1 pint nicotine sulphate; 80 gal. water).

If the above programme is carried out, further spraying to control pests should not be necessary other than the *application of DDT, when required for fruit fly control.* The timing of sprays for this pest will depend largely on local conditions and can best be decided by the orchardist.

Heliothis Control in Linseed.

T. PASSLOW, Assistant Entomologist, Science Branch.

HELIOTHIS,* in some seasons, causes severe damage to linseed crops in southern Queensland. The insect is of world wide distribution, attacking numerous weed species and many crops, including maize, cotton, tobacco, tomatoes, linseed, sunflowers and green peas. It is primarily a pest of these crops during seed production. In linseed the caterpillars, or grubs, cause damage by tunnelling into the capsules and feeding on the developing seed, and when present in large numbers may cause almost complete loss of the crop.

Life History and Habits.

The moth is a stout bodied insect with a wing expanse of 1½ inches, the forewings being brown to pink in colour and the hindwings creamy yellow, each with a large marginal smoky area. It has the peculiar habit when disturbed of flying low and rapidly over the crop, and alighting again within 50 yards. Each female moth is capable of producing about 1,000 eggs, which are deposited singly on the flowers. After a few days the caterpillars hatch out and feed on the developing

* *Heliothis armigera* (Hb.).

bolls. When fully grown they measure up to two inches in length and vary in colour from green to brown and almost black. Grubs of different ages may be found in a linseed crop but all belong to the one generation, being the progeny of the moths which emerge from the over-wintering pupae. This emergence commences with the warm weather of early spring and may continue for three or four weeks.

Control.

Boom spraying is the most widely used and effective method of Heliothis control in linseed. For best results DDT, in emulsion form, should be used at the rate of 1 lb. of active insecticide per acre, irrespective of the volume of spray applied. Fifteen gallons of spray per acre give adequate cover and usually one treatment shortly after moths become active during flowering is sufficient for crop protection.

Plate 124.

A Heliothis Moth. Wingspread 1½ in. Forewings brown to pink. Hindwings creamy yellow.

Heliothis is not present in pest numbers in linseed every season, the population being dependent to a large extent on the weather, and on food supply during the previous autumn. The practice of routine spraying is therefore an unnecessary expense in seasons of low Heliothis population. *Careful crop inspections for the presence of moths during flowering will indicate whether spraying will be necessary.* If large numbers are present severe damage can be expected. Prompt action at this time minimises crop damage and is preferable to delaying treatment until grubs and their damage are seen.

The practice of early planting (late April and early May) diminishes the risk of Heliothis damage, as moths usually do not deposit eggs before mid-September. Early planted crops, in normal seasons, produce the bulk of their flowers before this time and are not, therefore, attractive to the moths. Early sowing, however, does not guarantee escape from Heliothis attack and the usual precautionary crop inspections during flowering should be practised.

Armyworm Control in Cereal Crops.

T. PASSLOW, Assistant Entomologist, Science Branch.

ARMYWORMS* periodically cause extensive damage to cereals during autumn and spring. On the Darling Downs the caterpillars may attack ripening French millet, Japanese millet, panicum, Sudan grass, young oats, barley and wheat during autumn. Spring outbreaks are more usually associated with barley.

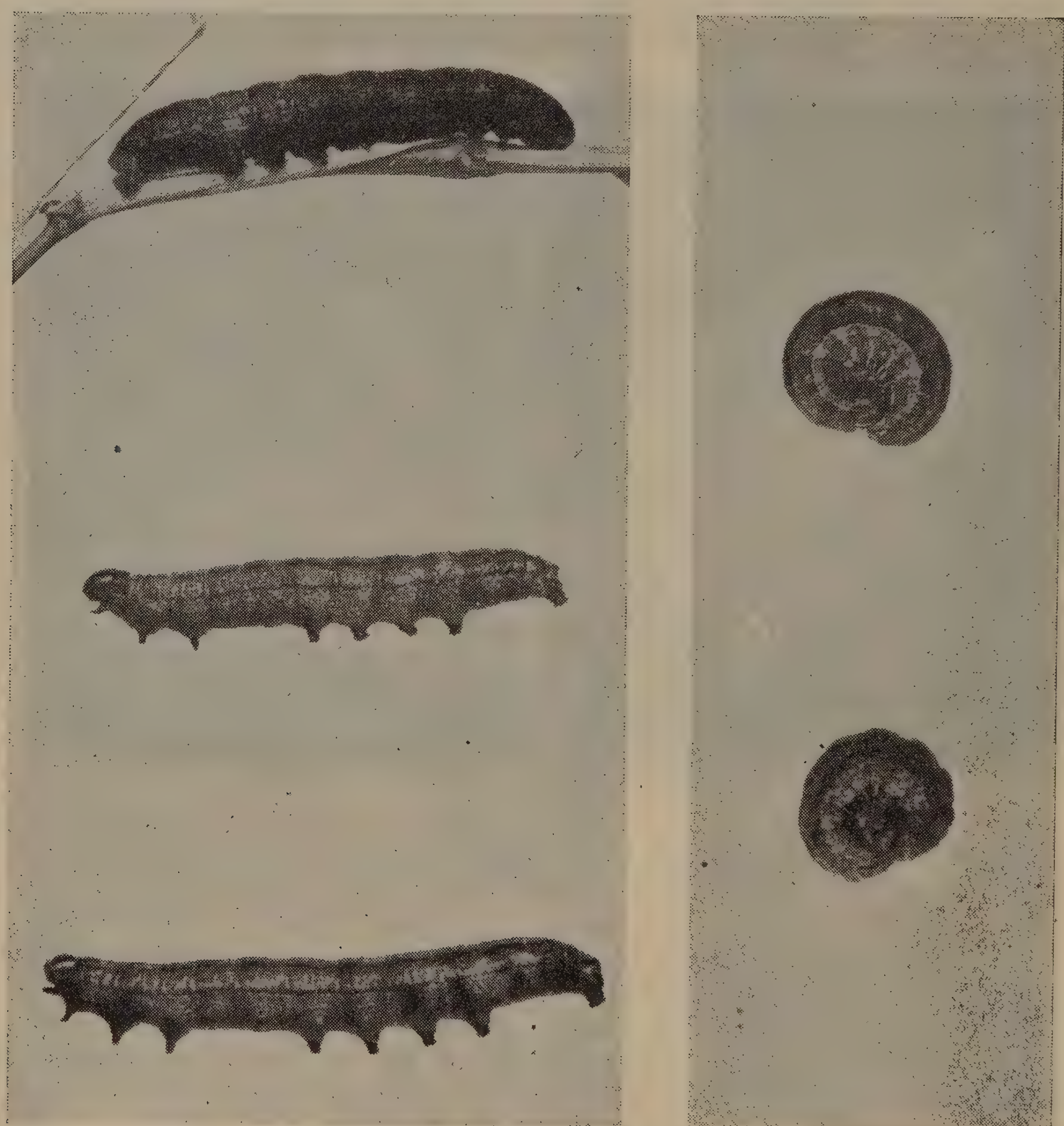

Plate 125.

Armyworm Caterpillars Extended and at Rest.

The armyworm moths are fawn to brownish in colour, about three-quarters of an inch long and $1\frac{1}{2}$ inches across the outspread wings. They are nocturnal and are seldom seen. The caterpillars also are

* *Cirphis unipuncta* (Haw.).

usually inactive during the day, resting in the soil, and nearly all their feeding is done at night. When mature they measure up to two inches in length and vary in colour from green to almost black, but all are marked with two longitudinal greenish stripes.

In most crops armyworms prefer to feed on the leaves, although when the plants are young these pests chew through the stems at ground level and consume all the aboveground portions. Also, when the plants have been defoliated or have dried out with maturity, the caterpillars attack the stems, chewing through just below the heads, which then drop to the ground.

Plate 126.

Damage to a Young Cereal Crop by Advancing Armyworms. The undamaged area is portion of a trial plot protected by DDT.

Two types of infestation occur. The more common one is a light but somewhat uniform dispersal of caterpillars resulting from a wide scattering of moths within a crop. The young caterpillars are usually unnoticed as they seldom cause damage of a serious nature. With growth, however, food requirements increase and damage seems to appear quite suddenly. The second and more spectacular type of infestation develops when the caterpillars are numerous and move on a definite front, eating all palatable food as they advance. These infestations are usually from external sources such as pastures and old cultivations.

Control Measures.

The nocturnal habits of armyworms and the apparent suddenness of attacks make it almost impossible to forecast outbreaks of this pest. Farmers therefore should at the first signs of damage apply control measures quickly.

The older method of control, namely baiting, will give good results and is recommended where suitable spraying equipment is not readily available. Baits may be prepared and used as follows:—

> Throughly mix 25 lb. bran and 1 lb. Paris green, and immediately prior to use dampen with 2 gallons of water to which 1-2 quarts of molasses have been added. Two pounds of lead arsenate or 2 lb. of BHC 4% dust (0·5% gamma isomer) may be substituted for the Paris green. The bait should be crumbly and not over-moist, and is best applied in the late afternoon. In most instances the quantities mentioned will give satisfactory results if distributed carefully over half an acre. Heavier dressing will be required when dealing with the pests moving on a front.

DDT spraying is a more convenient and effective method of controlling armyworms. Half a pound of active ingredient per acre, preferably in the emulsion form, is the rate of application recommended. Where the caterpillars are moving as an army, treatment of a strip on both sides of the front will be sufficient to halt the pest. The width of this strip will depend on the severity of the attack. In dispersed outbreaks the whole area in which the caterpillars are working will require attention.

DEPARTMENTAL PUBLICATIONS.

The Department has advisory leaflets and pamphlets on a variety of subjects available to Queensland primary producers free on application.

The Division of Plant Industry list includes the following:—

Advisory Leaflets.

No. 228. The Cultivation of Some Salad Vegetables.
No. 229. Broom Millet.
No. 234. The Grape.
No. 235. Bush Hay Conservation in North-western Queensland.
No. 237. Strawberry Culture.
No. 241. The Apple.
No. 242. Pumpkins, Squashes and Marrows, and Grammas.
No. 244. Citrus Growing.

Pamphlets.

No. 148. The Vegetation of South-eastern Queensland.
No. 149. The Papaw.
No. 150. Tropical Pasture Investigations.

Division of Animal Industry Advisory Leaflets include:—

No. 33. Cattle Drafting Yards.
No. 36. Infectious Calf Pneumonia.
No. 38. Ear Notching of Pigs.
No. 41. Bracken Fern Poisoning of Cattle.
No. 44. ''Swelled Head'' of Sheep.

Recent Animal Industry pamphlets are:—

No. 10. The Occurrence and Control of Worm Parasites of Sheep in Queensland.
No. 11. Parasitic Worm Diseases of Cattle.
No. 12. Milch Goats.
No. 16. Lamb Marking.

Among publications of the Division of Dairying are the following pamphlets:—

No. 7. The Cleaning and Sterilizing of Dairy Utensils and Equipment.
No. 8. The Care and Operation of Milking Machines.
No. 9. An Elevated Milking Bails.

Brucellosis Testing of Swine.

The Department of Agriculture and Stock is operating a scheme whereby pig herds are tested at intervals for the occurrence of swine brucellosis (contagious abortion).

A herd listed by the Department as ''brucellosis tested'' is one in which all such animals as may be determined by the Director of the Department's Division of Animal Industry have been subjected to two successive tests for brucellosis, at intervals determined by him, without any positive reactors being found.

In order for a herd to be retained on the list of Tested Herds, a semi-annual or annual re-test of the herd, as determined by the Director, is required. If at a re-test any animal gives a positive reaction to the test the herd is removed from the list; it is not listed again until subsequent tests, as determined by the Director, have been carried out.

Full particulars of the Brucellosis Testing of Swine and application forms may be obtained from the Under Secretary, Department of Agriculture and Stock, William Street, Brisbane.

TESTED HERDS.

(AS AT 11th SEPTEMBER, 1952.)

Breed.	Owner's Name and Address of Stud.
Berkshire	J. J. Bailey, " Lucydale " Stud, East Greenmount
	S. Cochrane, " Stanroy " Stud, Felton
	Garrawin Stud Farm Pty. Ltd., 657 Sandgate road, Clayfield
	G. Handley, " Handleigh " Stud, Murphy's Creek
	J. L. Handley, " Meadow Vale " Stud, Lockyer
	R. G. Koplick, " Melan Terez " Stud, Rochedale
	O'Brien and Hickey, " Kildurham " Stud, Jandowae East
	E. Pukallus, " Plainby " Stud, Crow's Nest
	G. C. Traves, " Wynwood " Stud, Oakey
	E. Tumbridge, " Bidwell " Stud, Oakey
	Westbrook Farm Home for Boys, Westbrook
	H. W. Wyatte, Rocky Creek, Yarraman
	H.M. State Farm, " Palen Creek," Palen Creek
	A. R. Ludwig and Sons, " Cryna " Stud, Beaudesert
	H. H. Sellars, " Tabooba " Stud, Beaudesert
	F. Thomas, " Rosevale " Stud, Beaudesert
	D. T. Law, Trouts Road, Aspley
	C. F. W. and B. A. Schellback, " Redvilla " Stud, Kingaroy
	R. H. Crawley, "Rockthorpe" Stud, via Pittsworth
	F. R. J. Cook, "Alstonvilla," Woolvi, via Gympie
	D. E. and E. C. Apelt, "Thelmur," Oakey
	Mrs. I. M. James, "Kenmore" Stud, Cambooya
	H. L. Stark, "Florida," Kalbar
	J. H. N. Stoodley, " Stoodville," Ormiston
	H.M. State Farm, Numinbah
Large White	H. J. Franke and Sons, " Delvue " Stud, Cawdor
	Garrawin Stud Farm Pty. Ltd., 657 Sandgate road, Clayfield
	F. L. Hayward, " Curyo," Jandowae
	J. A. Heading, " Highfields," Murgon
	K. B. Jones, " Cefn " Stud, Pilton
	R. G. Koplick, " Melan Terez " Stud, Rochedale
	R. Postle, " Yarralla " Stud, Pittsworth
	E. J. Bell, " Dorne " Stud, Chinchilla
	L. C. Lobegeiger, " Bremer Valley " Stud, Moorang, via Rosewood
	J. H. G. Blakeney, " Talgai " Stud, Clifton
	H. R. Gibson, " Thistleton " Stud, Maleny
	H.M. State Farm, Numinbah
	K. A. Hancock, " Laurestonvale " Stud, Murgon
	O. H. Horton, Mannuem, Kingaroy

TESTED HERDS—continued.

Breed.	Owners Name and Address of Stud.
Large White—*continued*	V. P. McGoldrick, "Fairymeadow" Stud, Cooroy N. Woltmann and Sons, Wooroolin R. S. Powell, Kybong, via Gympie E. B. Horne, "Kalringal," Wooroolin S. T. Fowler, "Kenstan" Stud, Pittsworth J. A. and J. McNicol, "Camden," Canning Vale, Warwick H. L. Larsen, "Oakway," Kingaroy
Tamworth	S. Kanowski, "Miecho" Stud, Pinelands N. R. Potter, "Actonvale" Stud, Wellcamp D. F. L. Skerman, "Waverley" Stud, Kaimkillenbun A. C. Fletcher, "Myola" Stud, Jimbour Salvation Army Home for Boys, Riverview F. Thomas, "Rosevale" Stud, Beaudesert A. J. Surman, Noble Road, Goodna P. V. McKewin, "Wattleglen" Stud, Goombungee Department of Agriculture and Stock, Regional Experiment Station, Kairi P. V. Campbell, Lawn Hill, Lamington E. C. Phillips, "Sunny View," M.S. 90, Kingaroy T. A. Stephen, "Withcott," Helidon W. F. Kajewski, "Glenroy" Stud, Glencoe A. A. Herbst, Bahr Scrub, via Beenleigh R. G. Koplick, Grieves Rd., Rochedale H.M. State Farm, Numinbah
Wessex Saddleback ..	W. S. Douglas, "Greylight" Stud, Goombungee D. Kay and P. Hunting, "Kazan" Stud, Goodna E. Sirrett, "Iona Vale" Stud, Kuraby C. R. Smith, "Belton Park" Stud, Nara H. H. Sellars, "Tabooba" Stud, Beaudesert H. Thomas, "Eurara" Stud, Beaudesert D. T. Law, Trouts Road, Aspley G. J. Wilson, "Glenbella" Stud, Silverleigh G. J. Cooper, "Cedar Glen", Yarraman J. B. Dunlop, Acacia Road, Kuraby A. Curd, Box 35, Jandowae

HAVE YOUR SEEDS TESTED FREE

The Department of Agriculture and Stock examines FREE OF CHARGE samples representing seed purchased by farmers for their own sowing.

The sample submitted should be representative of the bulk and a covering letter should be sent advising despatch of the sample.

MARK YOUR SAMPLE

Sample of .... seed
Drawn from .... bags
Representing a total of ....
Purchased from ....
Name and Address of Sender
Date......................

SIZE OF SAMPLE

Barley -	8 oz.	Oats -	8 oz.
Beans -	8 oz.	Peas -	8 oz.
Grasses	2 oz.	Sorghum	4 oz.
Lucerne	4 oz.	Sudan -	4 oz.
Millets	4 oz.	Wheat -	8 oz.
Vegetable Seeds -	½ oz.		

SEND YOUR SAMPLE TO—**STANDARDS OFFICER, DEPARTMENT OF AGRICULTURE AND STOCK, BRISBANE.**

ASTRONOMICAL DATA FOR QUEENSLAND.

NOVEMBER.

Supplied by W. J. NEWELL, Hon. Secretary of the Astronomical Society of Queensland.

TIMES OF SUNRISE AND SUNSET.

At Brisbane.			Minutes later than Brisbane at other places.					
Day.	Rise.	Set.	Place.	Rise.	Set.	Place.	Rise.	Set.
	a.m.	p.m.						
1	4.59	6.05	Cairns	45	12	Longreach	42	28
6	4.55	6.09	Charleville	29	25	Quilpie	33	37
11	4.52	6.12	Cloncurry	61	38	Rockhampton	17	3
16	4.50	6.16	Cunnamulla	28	31	Roma	18	15
21	4.48	6.20	Dirranbandi	17	21	Townsville	37	12
26	4.47	6.24	Emerald	26	31	Winton	49	31
30	4.46	6.27	Hughenden	46	24	Warwick	3	6

TIMES OF MOONRISE AND MOONSET.

At Brisbane.

Day.	Rise.	Set.
	p.m.	a.m.
1	5.27	3.56
2	6.32	4.34
3	7.37	5.17
4	8.39	6.05
5	9.36	6.58
6	10.27	7.54
7	11.11	8.51
8	11.50	9.48
9	..	10.44
	a.m.	
10	12.24	11.39
		p.m.
11	12.54	12.31
12	1.23	1.23
13	1.51	2.16
14	2.19	3.10
15	2.50	4.07
16	3.23	5.06
17	4.02	6.09
18	4.47	7.13
19	5.39	8.16
20	6.38	9.15
21	7.43	10.07
22	8.50	10.54
23	9.57	11.35
24	11.02	..
	p.m.	a.m.
25	12.06	12.11
26	1.09	12.46
27	2.11	1.19
28	3.13	1.53
29	4.17	2.30
30	5.21	3.10

MINUTES LATER THAN BRISBANE (SOUTHERN DISTRICTS).

Charleville 27; Cunnamulla 29; Dirranbandi 19; Quilpie 35; Roma 17; Warwick 4.

MINUTES LATER THAN BRISBANE CENTRAL DISTRICTS).

Day.	Emerald.		Longreach.		Rockhampton.		Winton.	
	Rise.	Set.	Rise.	Set.	Rise.	Set.	Rise.	Set.
1	13	24	29	40	3	15	32	46
6	10	30	25	45	0	21	27	53
11	15	23	30	39	6	14	35	44
16	25	13	42	28	16	2	48	31
21	30	11	45	25	20	0	44	7
26	19	19	35	34	10	10	39	39
30	11	27	26	43	1	18	29	51

MINUTES LATER THAN BRISBANE (NORTHERN DISTRICTS).

Day.	Cairns.		Cloncurry.		Hughenden.		Townsville.	
	Rise.	Set.	Rise.	Set.	Rise.	Set.	Rise.	Set.
1	15	40	40	58	25	43	14	34
3	6	50	35	63	20	49	6	42
5	3	55	34	67	18	52	4	45
7	7	52	36	65	20	50	7	44
9	15	45	40	60	25	46	14	37
11	20	37	43	56	28	41	17	32
13	29	26	50	47	35	33	25	22
15	39	16	56	41	41	26	33	15
17	48	7	63	35	48	21	40	8
19	55	3	68	32	51	18	45	4
21	54	6	67	34	51	20	44	7
23	45	15	61	41	46	26	37	14
25	34	21	54	44	38	29	29	18
27	22	32	45	53	30	38	19	42
29	12	43	39	59	23	45	11	36
30	8	48	36	62	21	48	8	40

Phases of the Moon.—Full Moon, November 2nd, 9.10 a.m.; Last Quarter, November 10th, 1.43 a.m.; New Moon, November 17th, 10.56 p.m.; First Quarter, November 24th, 9.34 p.m.

On November 15th the sun will rise and set 20 degrees south of true east and true west respectively and on the 13th and 26th the moon will rise and set at true east and true west respectively.

Mercury.—An evening object all this month. On the 1st, in the constellation of Scorpio, it will set 1¾ hours after the sun, and on the 10th will reach its greatest angle east of the sun. By the end of the month, still in the constellation of Scorpio, it will be in line with the sun and set about sunset. On the 8th it will be near Antares.

Venus.—Will be situated in the constellation of Ophiuchus at the beginning of the month, when it will set 2 hours 40 minutes after the sun. On the 20th the moon will be close by, and at the end of the month, in the constellation of Sagittarius, this planet will set 3 hours after the sun.

Mars.—In the constellation of Sagittarius, will set an hour or so before midnight during this month. On the 22nd the moon will pass very close to this planet.

Jupiter.—In the constellation of Aries, will now rise about sunset and be visible the whole night. The moon will be nearby on the 3rd and 30th.

Saturn.—Too close in line with the sun for observation at the beginning of the month, but by the end of the month, in the constellation of Virgo, will rise between 2.30 a.m. and 3.45 a.m.

THE CONSTELLATIONS.

Cetus (The Whale: a sea monster).

This is a large straggling group which lies between declination 10 degrees north and 25 degrees south. It lies close to the ecliptic, being south of Aries and Pisces and east of Aquarius. Menkar (Alpha Ceti) is at the southern apex of an equilateral triangle of which Hamal (Alpha Arietis) and the Pleiades form the base. It is also at the right-angle of a large 45-degrees triangle, with Hamal and Aldebaran (Alpha Tauri) marking the hypotenuse. A line from Aldebaran through Menkar and produced for about twice that distance will help to locate Omicron Ceti. This star, known as Mira, the Wonderful, was the first variable star to be discovered, being noted by Fabricus in 1596. Hevelius saw it between 1648 and 1662 and satisfied himself as to its variability. Mira is near the celestial equator. It has a mean period of 330 days. It is invisible without a telescope for about five months, sinking to a minimum of 8.5 or 9.6 mag., then it becomes visible to the naked eye for a period of about six months, rising to a maximum usually of 3rd or 4th mag. but sometimes to 2nd magnitude. At maximum the light increases about 1,400 times, apparently due to outbursts of hydrogen gas. Mira is one of the largest stars known, being about 400 times the diameter of our sun and being surpassed in size only by the giants. In 1923 it was found that Mira had a white dwarf companion at a distance of one second of arc. The companion is only 0.04 the size of the sun, making an oddly assorted pair—one of the largest and one of the smallest. Continuing the line from Menkar through Mira will bring us to Zeta Ceti, a 4th magnitude star at the eastern end of a rough quadrilateral of stars of which the others are Theta, Eta and Tau, all of about 3rd magnitude. Beta Ceti sometimes called Deneb Kaitos, is a 2nd-magnitude star to the south-west of this quadrilateral.

Pisces (The Fishes).

Pisces is a zodiacal constellation which lies on the ecliptic between Aries and Aquarius and to the south-east of the Great Square of Pegasus. The group is not easily distinguished but contains some interesting telescopic objects. It is important, too, for the fact that at present it contains the equinox or first point of Aries, the point at which the sun crosses the celestial equator on its apparent journey from south to north.

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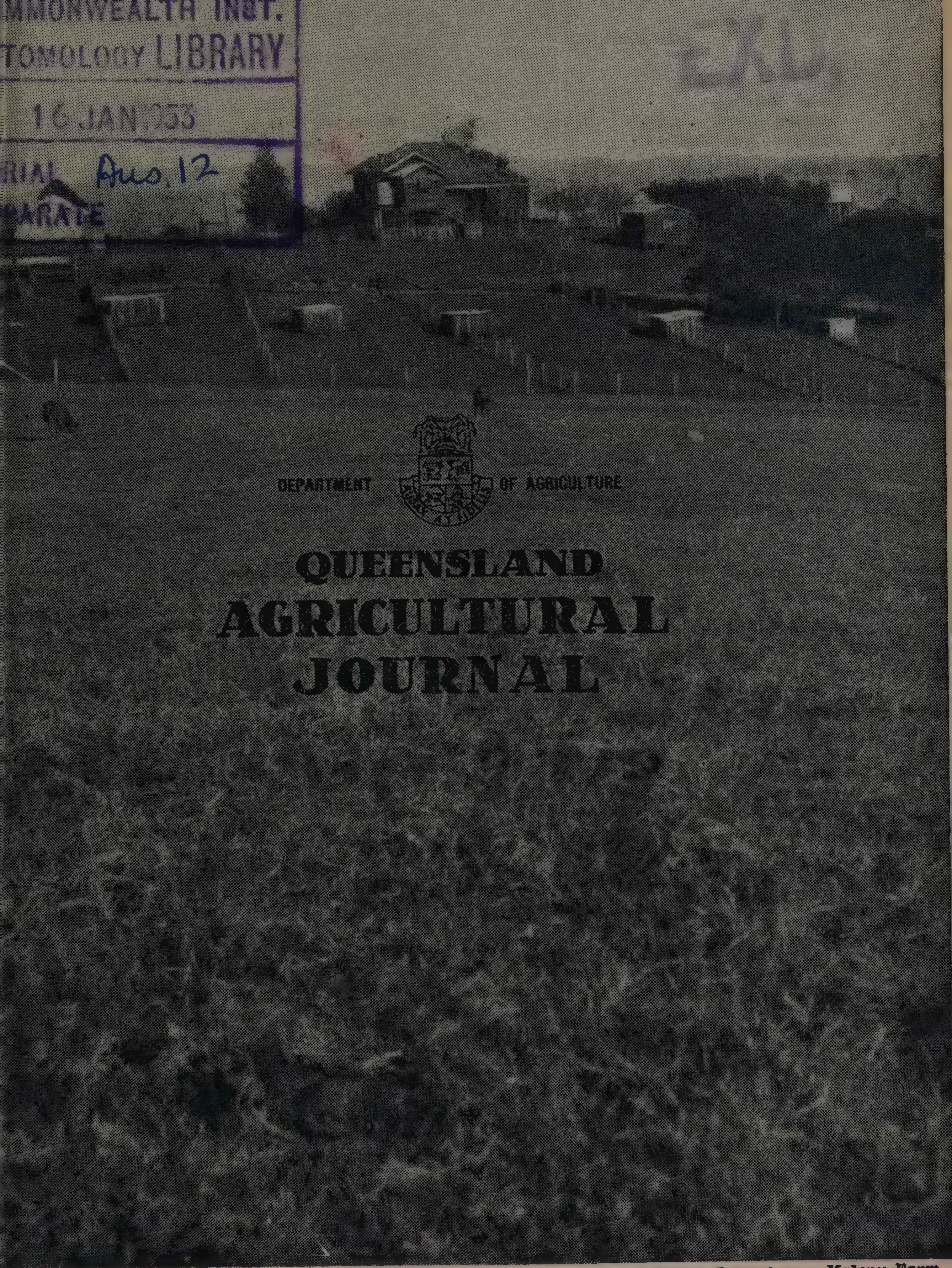

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QUEENSLAND AGRICULTURAL JOURNAL

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Rayford Park Date Grove

Maize in the South Burnett

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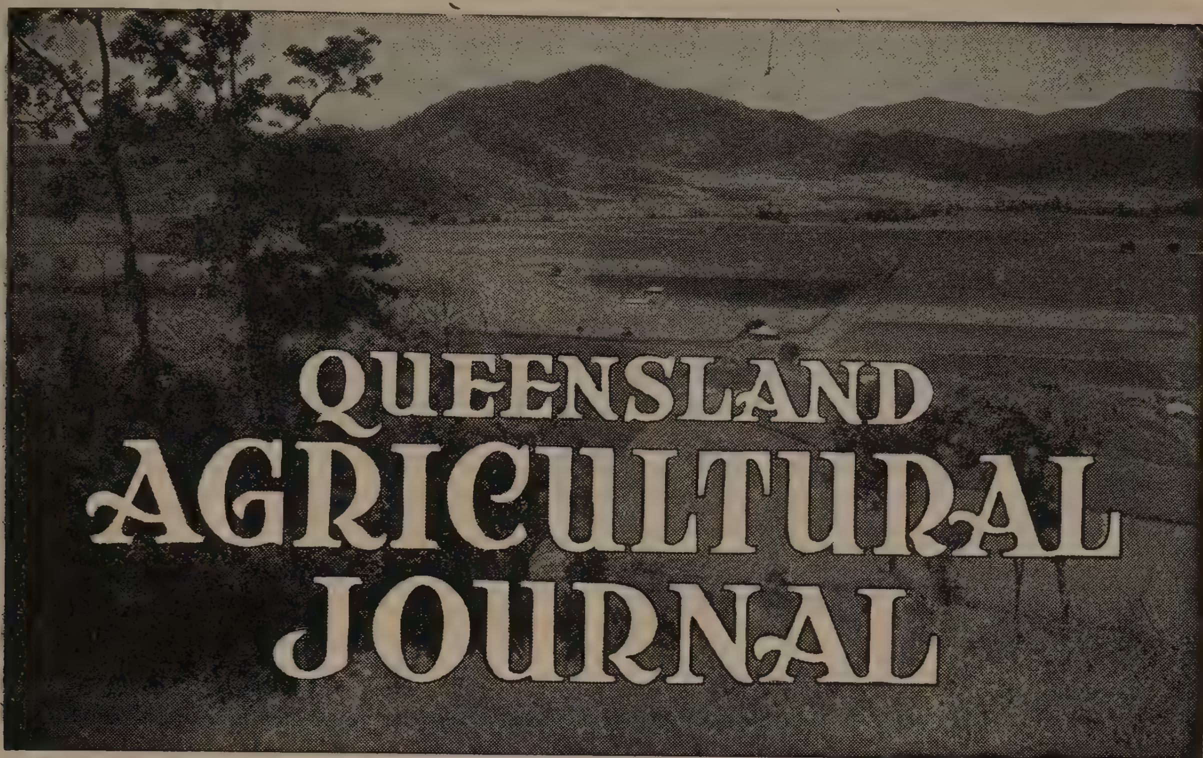


Some Overseas Agricultural Practices Which Could Assist Australian Production.

ARTHUR. F. BELL, Under Secretary.*

WHILE overseas as a delegate to a conference of British Commonwealth sugar producers, I took the opportunity to make a short survey of current agricultural trends in several countries.

First and foremost I was struck with the marked and sustained progress in agriculture in the United Kingdom over the past dozen years. Britain may well be regarded as the spiritual home of scientific agriculture and the world owes many of the modern agricultural practices, and breeds of animals and plants, to British initiative.

Nevertheless, British agriculture had generally been in a decline over the first 40 years of this century. It experienced a revival during the first world war but was soon allowed to fall back again. The second world war found the United Kingdom with a very considerably increased population, and with the immediate operation of intensive submarine warfare, the position was soon critical. The farmers rose nobly to the occasion; production was soon markedly increased, and again the country survived a state of siege.

In *this* post-war period, however, it would appear that the lessons of the past are not again to be thrown into the limbo of forgotten things. The necessity for stable and remunerative prices and wages in agriculture has been accepted and British agriculture is now in a healthy condition. Moreover, the methods being followed by the general run of farmers are very sound, and yields per acre or per animal are such as to rouse the envy of the visitor.

* In a recent A.B.C. broadcast.

However, one thing which gives the visitor some cause for uneasy thought is the very high degree of mechanisation on the farms. Britain is probably the most tractorised country in the world and the draught horse has almost disappeared—probably down the throats of coursing greyhounds. Since the tractors are run on imported fuel, one wonders what could be the effect of interrupted supplies of liquid fuel in wartime. Without fuel the farmers would be forced back to wheel-barrows and garden forks.

Undoubtedly one of the important factors in the wartime step-up in food production in Britain was the institution of the County Agricultural Committees. These committees, and their local committees, were composed of successful practical farmers and they were assisted by the scientists and technicians of the Ministry of Agriculture and Fisheries and various research organisations. The object of the committees was to increase production by channelling the means of production to the farmers, and by raising the standards of farm management. They were clothed with quite extensive powers and could, in fact, displace any farmer who persisted in uneconomic or inefficient farming methods. It is true that these powers were rarely used, the below-average farmer usually responding to the advice of the committee.

This system proved so successful in war that it has been continued in peace, and one must pay tribute to the public spirit of the members of these committees who continue to serve their country in an honorary capacity.

This is a feature of British agriculture which could well be adopted here and the Minister for Agriculture and Stock in Queensland (Mr. Collins) recently urged farmers' organisations to adopt this principle in a drive to increase efficiency and reduce costs. There is a very wide gap between the most efficient and the least efficient farms. Advice on farm management from farmers in the top bracket, assisted by Agriculture Department specialists, would go a long way to assist the young, and the inexperienced, or the farmer who has had a "run of outs."

Britain is now much more diet conscious than in pre-war days and the need for adequate and continuous supplies of high quality fresh milk is fully appreciated. This has called for greater production on the dairy farms and it is of interest to note that although the number of cows has increased by only 10 per cent. over the pre-war level, the volume of production has increased by about 50 per cent., and this has been achieved in the face of a drop of about two-thirds in the importation of feed concentrates.

Without doubt the most important example set us by the dairymen of Britain and the other countries I visited is the production and conservation of fodder to feed their stock over the winter period. The cows must be stalled each year for a period of five to seven months,

during which they get no grazing. In effect, this is equivalent to a drought every year, yet not only are no cows lost by death but production is maintained at high levels.

The monetary return per gallon of milk was not materially different from that in Australia, and the cost of fodder conservation, balanced rations, and winter stabling is met by the increased yield per cow, which is about twice the Australian average. The farmer's objective is a smaller number of high-producing cows rather than a large number of mediocre producers. The average milking herd in England is only 15, and it is less in Western Europe.

The topdressing of pastures is universal and the post-war development of the use of nitrogenous fertilizers is outstanding. Meadows are commonly dressed with 1-1½ cwt. of sulphate of ammonia, or its equivalent, per acre; this is a heavy dressing when we consider that growth is at a standstill over the winter. It gives a good growth of high-protein grass and permits the haying or ensiling of heavy tonnages. Without doubt one of our greatest needs here in Australia is relatively cheap nitrogenous fertilizers.

Artificial drying of hay is making considerable headway in Britain, where showery conditions are common. The drying process costs somewhere about £10 per ton but the product is an excellent hay of about 18-20 per cent. protein and 10 per cent. moisture; on one farm I saw a very ingenious and successful method of dealing with hay which had had showery weather for a week after cutting. It was picked up wet with a buck rake and piled in a long narrow stack, the stack being compressed by running a tractor over it during building. When the stack was about six feet high it was covered top and sides with a layer of about six inches of soil, the soil being excavated and spread with a tractor front-end loader.

This is called a "clamp" silo on account of its similarity to the clamp system of storing potatoes over winter. In this particular case two men collected and stacked 45 tons of hay in one day and then took about three-quarters of a day to cover the top and sides with soil. Silage from an adjacent clamp, put down the previous year, opened up in first-class condition.

Artificial insemination of dairy cows, and to a less extent beef cows, was found to be standard practice and has done a great deal to raise the quality of the stock. With the small herds characteristic of Europe it is too costly to run a first-class bull on the average farm and eventually about half the cows are served from the artificial insemination or "A.I." centres.

In Britain, artificial insemination of both dairy and beef cows is done on behalf of the Ministry of Agriculture by the Milk Marketing Board. The Board commenced its AI centres in 1945, and there are now 22 centres, with about 70 sub-centres, where first-grade bulls are

maintained. Each centre is run by a local committee of farmers with a veterinary officer in charge. In 1945-46, the first year of operation, 6,401 cows were inseminated, and for the year 1951-52 it was expected that the total would be about 800,000. In the United States the yearly total is about 5 millions.

Although this system has been so successful in Europe, and could with advantage be adopted in parts of Australia, the larger herds and greater distances would be factors militating against its general adoption.

One of the interesting developments in the United States is the adoption of maize-breeding technique in animal breeding. The maize breeders found that after crossing pure inbred lines of maize the resultant hybrid gave a much higher yield than either parent. The planting of this hybrid maize has increased acre yields in the United States by about 25 per cent. This method is now being applied on a large experimental scale to the breeding of cattle, sheep, pigs, and poultry. This work has gone furthest with dairy cattle and the United States Department of Agriculture has over the past 10 years carried out extensive experiments in the crossing of Jerseys, Holsteins, Guernseys and Red Danes. Cows from crosses and first back-crosses between these breeds are yielding about 30 per cent. more milk than their dams in the pure breeds.

Rural labour problems are not confined to Australia. Even in those closely settled countries where it is difficult to get more than a mile or two from a bitumen road, or a shop, there still seems to be an urge to the city. There are interesting attempts to meet this situation and of these the battery egg production in England and the assembly line dairies of California are symbolic. Both these operate on the principle of housing the animals in large concentrated units on the outskirts of the city, where workers are employed like shift workers in secondary industry. On one assembly line dairy near Los Angeles, there were 1,400 cows on 10 acres; they were fed mechanically and milked round the clock by shift workers who lived in the city. The cows had no grazing and every ounce of feed had to be purchased, but annual production per cow was around the 1,000 gallon mark.

In talking about agriculture I have had a good deal more to say about animals than crops. And this, I think is the important lesson which the Old World holds for us: Farming which is restricted to ploughing and the cultivation of cash crops is not a permanent system of agriculture under usual circumstances. Only by the rotation of crop land to animal grazing can fertility be maintained indefinitely. The farm lands of Europe with their proven age-old cycle of cropping and grazing should ever be before our minds as we plan our long-term farm operations.

The Rayford Park Date Grove.

A. M. RICHARDSON, Adviser in Horticulture.

IN 1937, Dr. W. A. T. Summerville, then on the Department's horticultural research staff, returned from a visit to America with seed of several date varieties. These were planted at Biloela, on what is now the Regional Experiment Station, and the seedlings were later transplanted to a number of western districts. One relatively large planting at Rayford Park, near Miles, has been under more or less continuous observation, and most of the factual information on date production in Queensland has been derived from this property.

RAYFORD PARK PLANTING.

Two of the main handicaps to the establishment of a date industry are the difficulty of getting offshoots from parents with a known record of high production and the need for careful attention to the young plants after they are set out in the grove. Only a small proportion of the palms planted ever reach maturity. This is in part due to the rather severe winter conditions in western areas, but perhaps more important is the lack of any tradition of orchard management in those parts of the State which are suitable for date culture.

Rayford Park was selected for a date grove in 1938, shortly after seedlings of known parentage became available. The property is reasonably accessible and the land is typical of much western plain country in the 25-inch rainfall belt. The bulk of the rain (about 60 per cent.) occurs during the summer months and heavy falls can normally be expected from January to April. The climate of the district is typically that of the subtropical inland, with a cool winter, a hot summer and a rather wide temperature range during the day. The mean maximum temperatures for January and July are respectively 91·4° and 67·0°; mean temperatures for the same months are 66·5° and 38·5° respectively.

VARIETIES.

Seedlings of six varieties were planted at Rayford Park. They were Daglet Noor, Zahidi, Barhee, Thoory, Halaway and Macktoom. All are recognised commercial types which play an important part in world commerce, and plants grown from seed are reputed to closely resemble the parental type. The characteristics of these varieties are fully described in American literature and the more salient features of each are given hereunder.

Plate 127.

Date Grove at Rayford Park. The palms flank a long drive from the road to the residence.

Daglet Noor.—Trunk moderately slender to heavy. Leaves olive green, long and slightly arched with stiff pinnae. Fruit coral red when immature, amber when ripe and mahogany red when cured; very subject to rain injury; semi-dry type. Offshoots slender, 8-12; usually set low on the palm.

Zahidi (Plate 128).—Trunk moderately robust with a compact crown. Leaves light green, with a slightly curved midrib and closely set pinnae. Fruit yellow when immature, light brown when ripe and reddish-brown when cured; susceptible to rain damage; a semi-dry date. Offshoots 15 to 25; usually set high on the palm.

Plate 128.

Zahidi Date Palm. A 10-year-old palm with offshoots and leaf trash removed.

Barhee.—Robust trunk. Leaves elm-green, moderately to slightly curved, with slightly drooping pinnae. Fruit yellow when immature, amber when ripe and golden-brown when cured; a late-maturing dessert date with a distinctive wedge shape. Offshoots 6-8; usually set low on the palm.

Thoory.—Robust trunk. Leaves yellow-green, with broad, rather crowded pinnae. Fruit yellow when immature, light brown to reddish when ripe and dark reddish-brown when cured. Offshoots, 6-8; set moderately high on the palm.

Halaway.—Palm with an open crown. Leaves deep green, moderately long and slightly curved, with broad, stiff pinnae. Fruit yellow when immature, light amber and wrinkled when ripe and golden brown when cured. Offshoots, 10-15; set moderately high and characterised by a narrow neck.

Macktoom.—Trunk moderately robust. Leaves light green. Fruit medium to large, yellow when immature, amber when ripe and reddish-brown when cured; a high quality dessert date. Offshoots 8-12; set at a height of 2 to 3 feet.

LAND PREPARATION AND PLANTING.

The land selected for the date grove comprised about three acres of grey sandy loam overlying a heavy clay subsoil. The surface soil was far from uniform in depth and its fertility was low.

After the area had been securely fenced, the ground was ploughed deeply and worked down to a fine tilth for planting in May, 1938. As the palms were to be interplanted with citrus, a spacing of 60 feet was allowed in the grove. Holes three feet square and 18 inches deep were dug and each refilled with half a hundredweight of well rotted cow manure mixed with topsoil. After the soil had been allowed to settle, the palms were planted at a depth that left them in a shallow basin four inches deep and four feet wide which facilitated later waterings. Immediately after planting, the ground was thoroughly soaked in the vicinity of each palm, and the grove was subsequently watered at weekly intervals for several months.

The grove contained 75 palms.

PROPAGATION.

Young palms produce a considerable number of offshoots each season. These offshoots are identical in character with the parent plant. Commercial groves of date palms should normally be established from offshoots, but their removal from the parent plant is a very exacting and difficult task, requiring a great deal of experience.

When sufficiently mature to transplant, the offshoots are usually about two years old, have a diameter of 6-8 inches and weigh approximately 20 lb. Great care must be exercised in handling them, for rough treatment may injure the heart tissue and prevent re-establishment. If the offshoots have to be removed any distance, it is necessary to ensure that the small fibrous roots do not dry out. The plant must therefore be balled correctly and packed with long straw or some other suitable material which will hold moisture and keep the offshoot cool and damp. Establishing a date palm grove from offshoots could be very costly.

The date palm is highly hybridised and seedlings exhibit widel differing characteristics unless pollination is controlled. There are number of reliable and simple methods of applying pollen to the femal palm. With controlled pollination, the seedlings produced from th reasonably pure strains at Rayford Park should reproduce most of th parental characteristics.

Date seeds germinate very slowly and irregularly, often taking year or more to break natural dormancy. Of the several methods o preparatory treatment tried, stratification of the fresh seed in san gave outstanding results, and it has been used for several years a standard practice. In the autumn the seeds are placed in shallow boxe or gardener's "flats" in closely packed layers alternating with tw inches of clean sharp sand. The boxes, each of which contains thre layers of seed (totalling 500 to 600), are placed in a trench two feet dee and covered with timber lids, the trench being then filled in with soil The seeds are thus kept moist, and readily germinate in spring, whe they are lifted and sown in specially prepared beds. Seeds are plante in the nursery bed three inches apart in the row with one foot betwee rows. When the seed is handled in this way, germination is reliabl and even.

If growth has been satisfactory, the seedlings may be transferre to 3-inch metal tubes in late autumn, and held in a sheltered positio until spring. They are then about 15 inches tall, possess a good roo system and can be safely despatched for long distances. If they remai longer than one year in the nursery beds, the seedlings develop a ver deep rooting system and are difficult to handle. Palms may also b sent out direct from the nursery bed if the roots are carefully balle and covered with damp straw held in place with hessian.

CARE OF THE YOUNG PALMS.

Although mature date palms can withstand relatively sever climatic and soil conditions, the young plant is very sensitive to its environment. Special attention has, therefore, to be given to cultivation, irrigation, removal of offshoots, pruning and frost protection.

Cultivation.

The date grove at Rayford Park was regularly cultivated during the first two years after planting, particularly during the dry spring and early summer months, when grass and weeds tend to compete with the palms for soil moisture. Only four of the seedlings had to be replanted and these were rather weak plants when received. By 1940, the palms were well established. World War 2 then intervened and the property was temporarily taken over by the military authorities. The period of occupation lasted for two years. During that time the palms received no attention, but all were subsequently quickly restored to normal vigour by frequent cultivation and liberal watering. The fact that the palm can survive such neglect may be attributed to its natural hardiness once a good root system is established.

Irrigation.

The established date palm thrives under the normal climatic conditions of the Darling Downs and adjacent pastoral districts even though stress conditions are common during the spring and early summer. The young palms, however, soon react to lack of soil moisture,

and flood irrigation is therefore highly desirable for at least two years after planting. In the Rayford Park Grove, the soil was never allowed to dry out when the plants were young, but the period between waterings was gradually increased later to approximately two months.

Removing Offshoots.

In most perennial plants which are reproduced vegetatively, unrestricted development of offshoots tends to weaken the parent. This is particularly so when the offshoots remain attached to the parent for a considerable time (two years or so in the date) before they are a suitable size for transplanting. In the Rayford Park project, maximum growth and vigour in the palm were primary considerations and all offshoots were therefore removed in the very young stages. The rate of offshoot production declines with age and those which now appear on the 14-year-old palms invariably lack vigour.

Pruning.

In the date palm, pruning is confined largely to the removal of dead leaves, spines and any green leaves protruding through or interfering with the fruit clusters on the bearing plant. The work is done in the spring of each year, the leaf being cut well back to its base. The work presented no special problems.

In this grove, however, several young palms were affected by a constriction at the growing point. The young fronds were bunched together and failed to open normally. This trouble occurred only during the first three years after the plants were established. Affected palms were treated by making a deep incision from the "throat" of the plant for about 10 inches down the stem. A pruning knife proved a suitable instrument for the job and the operation was carried out in spring. Subsequent growth was in all cases normal.

Frost Protection.

Severe frosts are experienced from time to time on the Darling Downs. Protection of the date palms was found to be essential at Rayford Park, where the ground is flat and little or no air flow takes place. Various methods were used at the outset, but all were finally discarded in favour of straw wrapped around the palm and allowed to protrude through the fronds. The straw was securely tied in position at the base of the palm and also just below the throat. Straw is readily available in the district.

Although severe frosts were encountered during the 10-year period from planting, none of the offshoots suffered damage. Apparently the fronds of the parent plant protect the offshoots and practical frost protection would appear to be concerned primarily with the growing point of the plant.

Frost protection was required only for the first two years after planting.

FLOWERING AND FRUITING.

As the palms were grown from seedlings, the two sexes were fairly evenly distributed in the grove. Prior to flowering, plant growth was singularly uniform. Some palms in all varieties except Zahidi threw their first inflorescence within six years of planting and all blossomed

regularly after their eighth year. Zahidi had still not flowered freely and shows little signs of coming into full bearing. Flowering takes place in October.

Plate 129.
Date Palm with Flowering Spikes. Flowers are thrown in profusion during spring.

Owing to the relatively high proportion of males in the stand, the fruit set has been consistently good and hand pollination has not been necessary. The fruit matures in March.

Varietal Behaviour.

The seedling palms reproduced the recorded parental characteristics with marked uniformity. This is presumably the result of clonal propagation of selected strains for very long periods in the Near East. It would appear, therefore, that with controlled pollination it might be feasible to establish commercial groves from seedling material. Males in the initial stand could be replaced by offshoots from the female palms when the two types can be segregated at the first flowering.

The suitability of the several varieties planted at Rayford Park for Queensland conditions can already be determined. Sufficient information is now available to indicate that Zahidi, Thoory, Daglet Noor and Barhee should all grow well in southern Queensland. Of these, Daglet Noor is perhaps the most attractive (Plate 130). It comes

into bearing early, the fruit clusters appearing at six years of age, and the fruit is carried in long, loose strands. Yields of 500 lb. per palm have been recorded in 8-year-old palms. Unfortunately, this variety is particularly subject to the disorder known as "black nose" if the fruit ripens under wet or humid conditions.

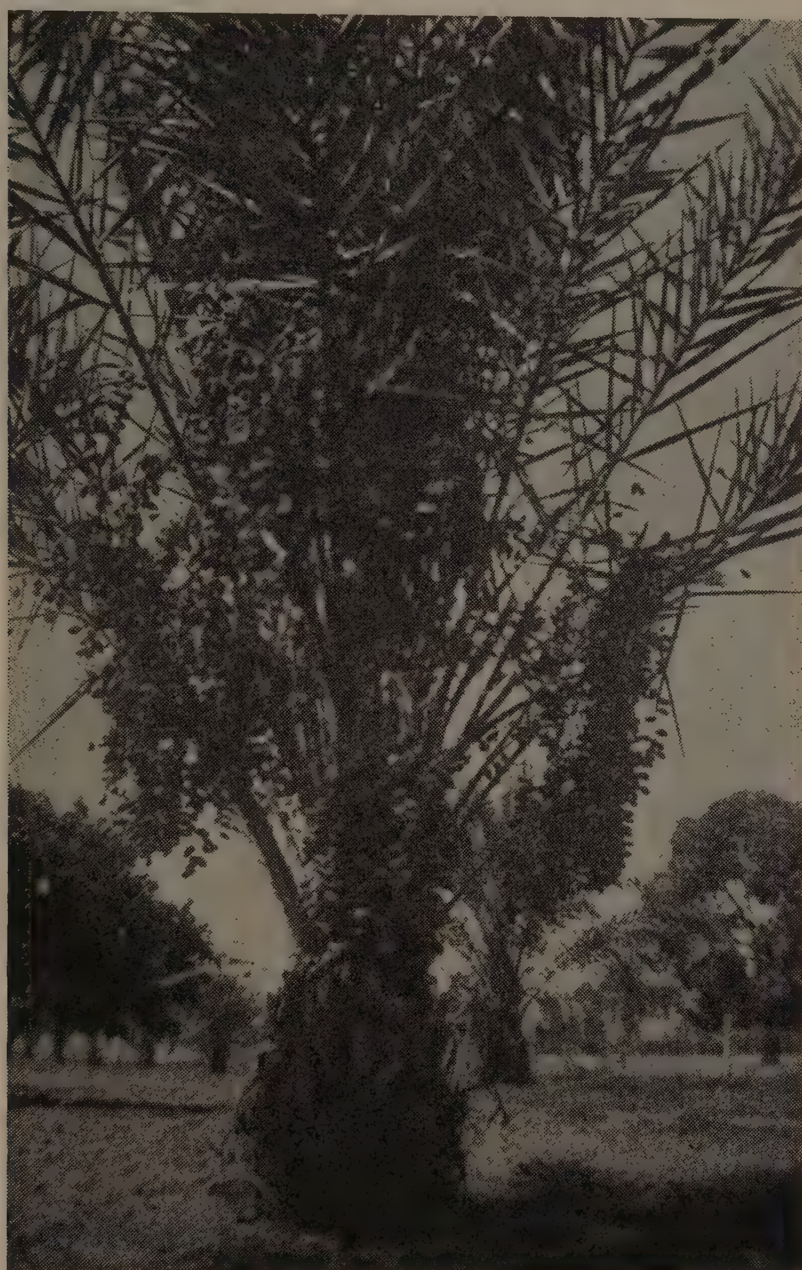


Plate 130.

Daglet Noor Date Palm with Fruit Clusters. The palm is eight years old and carries 10 clusters of fruit.

The two varieties Halaway and Macktoom may be less suitable for conditions in Queensland, as both produce an excessive number of small clusters and the fruit ripens unevenly. The latter fault is particularly serious if the summer rainfall is heavy. A short harvesting period is therefore a distinct advantage. Both varieties are, however, reputed overseas to be more tolerant of rain damage than the four previously discussed.

Plate 131.
Date Cluster on a Thoory Palm. A single strand carries several hundred fruit.

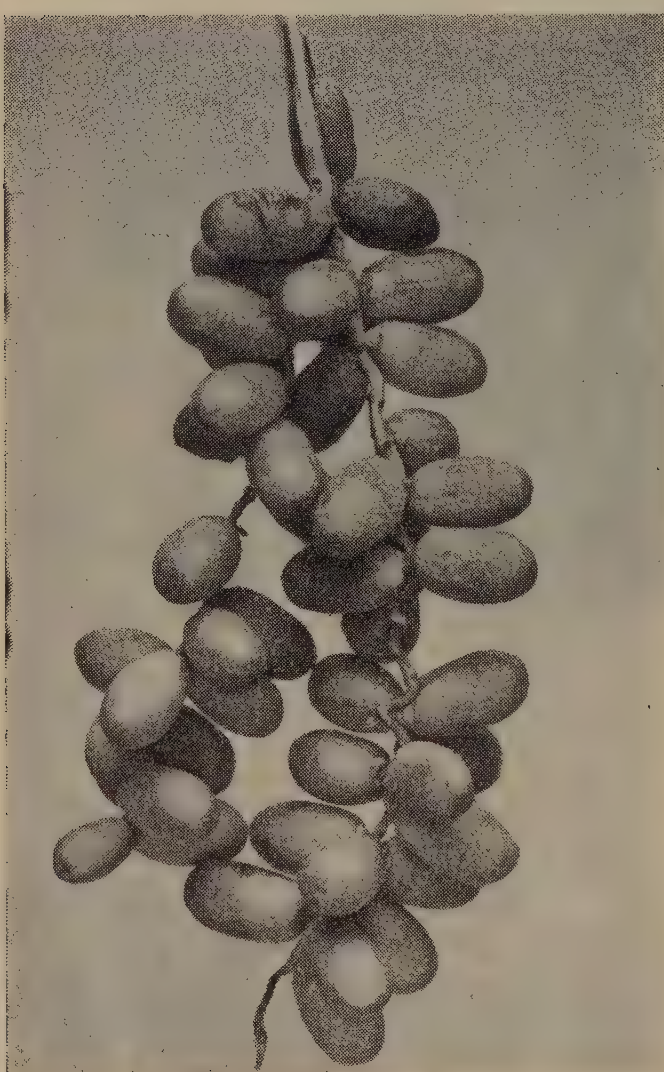


Plate 132.
Mature Fruit Daglet Noor.

Plate 133.
Mature Fruit of Zahidi.

Plate 134.
Mature Fruit of Thoory.

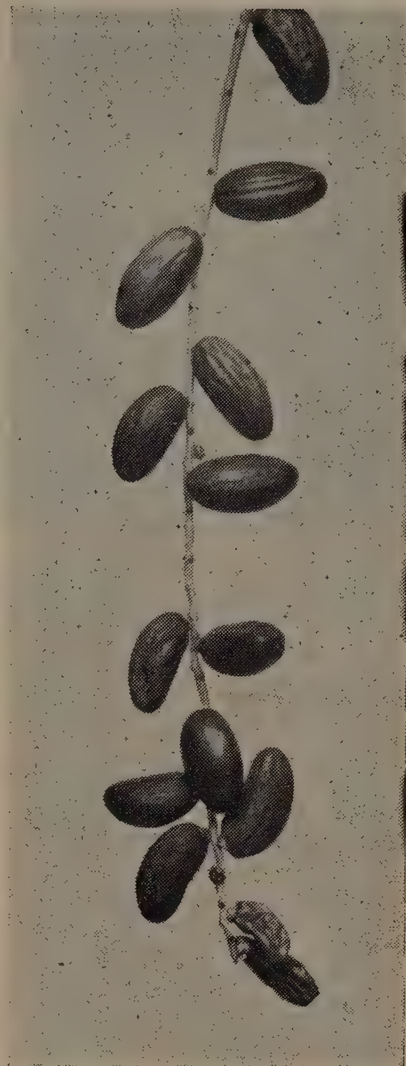


Plate 135.
Mature Fruit of Barhee.

PESTS AND DISEASES.

The palms in the Rayford Park grove have been very free from pests and diseases. An occasional fruit fly was, however, recorded in over-ripe fruit.

The disorder "black nose," mentioned earlier in connection with Daglet Noor, is characterised by a blackening of the flesh at the distal end of the fruit. This disorder, as well as skin cracking, which has occurred in all varieties, indicates that the main cultural problem of date production in Queensland is wet weather when the fruit is maturing on the palm. Fruit wastage after heavy summer rain is sometimes heavy and a rain-tolerant date is therefore essential for commercial production.

ARTIFICIAL RIPENING AND CURING.

To obtain the best quality fruit, the dates should be allowed to ripen on the palm. While the bunches are ripening, they may be protected from rain, birds and insects by a paper or cheesecloth covering. Most varieties, however, can be harvested in the green mature stage and ripened after harvesting. At this stage, the fruit is firm and easy to handle and the possibility of the crop being ruined by rain is greatly reduced.

Growers with a few palms may cut off the entire bunch near the trunk of the palm after a few fruits have ripened. The cut end of the fruit stalk is then kept in water and most of the dates ripen normally.

Green mature fruit which has to be ripened and cured should be rolled to and fro over damp towelling to remove the adhering dust. A final cleaning should be given when the curing is completed.

Where large quantities of dates have to be ripened, the fruit may be stacked in trays in a room or cabinet that can be heated. If necessary, the humidity can be increased by hanging wet sacks near the fruit. With temperatures between 90 and 100° F., nearly-ripe fruit will be fully ripened in a few days. As soon as the flesh near the seed becomes soft it is ready for curing. This stage in the ripening process is easily determined by squeezing the date at the shoulder; if the flesh is firm, the fruit is still unripe.

Curing the fruit consists in quickly drying the dates until the flesh becomes pliable. Excessive heat must not be used, for it produces dark-coloured and syrupy fruit. Good ventilation is, therefore, necessary. The dates may be cured out of doors by placing them in shallow trays covered with a cloth shade.

Cured dates should be stored in a dry, cool place. Uncured dates can be kept for several weeks in a household refrigerator and used as required.

BEEKEEPING AND PESTICIDES.

Beekeepers often worry about poisonous dusts and sprays applied to crops and trees at times when these are attractive to bees. It should be accepted that farmers must use insecticides which are necessary to control insect pests.

An important point is that Departmental recommendations of insecticide sprays and dusts are based on the minimum requirements necessary to achieve pest control. At the same time every consideration is also given to health hazards, and any probable adverse effects on an industry such as honey production.

It is, however, an essential part of bee husbandry for every beekeeper to familiarise himself with the latest spray and dusting recommendations used by farmers in his locality.

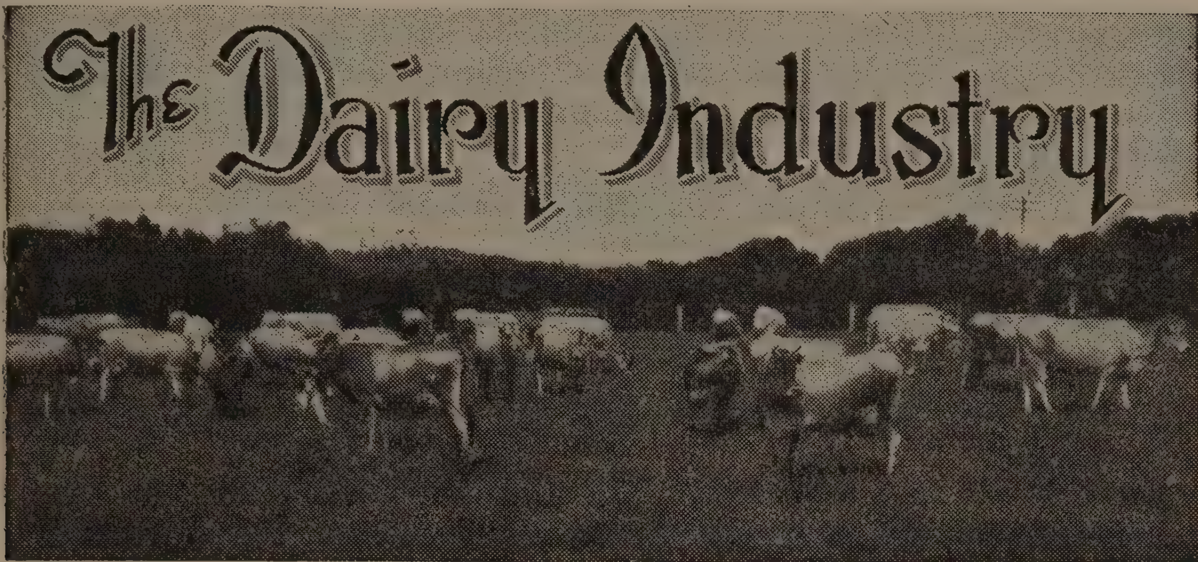
Progressive and experienced beekeepers who have adopted this practice are in a position to avoid possible losses.

SALE OF DISEASED CATTLE.

A reminder that under the *Diseases in Stock Acts* there is implied a condition on the sale of cattle that none are suffering from tuberculosis, brucellosis or mastitis was given to sellers and buyers of stock recently by the Minister for Agriculture and Stock (Honourable H. H. Collins).

Mr. Collins said that, under the *Diseases in Stock Acts*, the buyer has legal redress against the seller if tuberculosis is shown within 30 days of the sale (or delivery, if later) or if brucellosis or mastitis is detected within seven days.

Instances of persons buying dairy herds and discovering some time later that many of the cattle were affected with tuberculosis have come to the notice of his Department, said Mr. Collins. As buyers have no redress under the *Diseases in Stock Acts* unless infection with tuberculosis is proven within 30 days, tuberculin testing soon after purchase is recommended.



The Maintenance of Phage-Free Cheese Starter Cultures.

V. R. SMYTHE and L. G. LIGHTBODY, Dairy Research Laboratory, Toowoomba.

(*Continued from page* 206 *of the October issue.*)

BACTERIOPHAGE BEHAVIOUR IN THE CHEESE VAT.

The presence of phage in the cheese vat is very common and at times the titre of the phage can reach a very high order with the vat apparently still working normally. Where one starter strain has been used alone, titres as high as 10^7 at milling have been obtained without sign of a vat stoppage. When two strains are used in the vat, the titre of phage against either strain does not become so great, 10^2 or 10^3 being usual.

In the event of a vat stoppage, a sudden increase in the phage concentration at the time of the stoppage has been noticed. One slow vat studied contained S1 and KH. Acid production first slowed down in the whey with the bacteriophage titre for S1 at the level of 10^4. The titre of this phage did not increase thereafter, indicating that the cells of this starter strain had been practically wiped out. The vat finally stopped after the whey had been run. The titre of phage for KH at this stage was 10^5. On the same day, an adjoining vat which worked well using the same two starter strains had phage titres of 10^3 for both at milling.

These results point to the critical phage concentration in a two-strain vat being of the order of 10^4. It is possible, however, to get phage concentration in excess of this critical level without a vat stoppage occurring. This happens when the contamination of the vat with phages takes place after the milk is set with rennet. After setting and cutting, the whey is constantly draining out of and away from the shrinking curd. The starter cells within the curd are thus naturally protected and continue making acid. Such a vat will not be slow. On the other hand, when the bacteriophage infection occurs prior to setting, this infection becomes bound up within the curd in close association with the starter cells. The cells then can be lysed and a slow vat can result.

Thus it is clear that from the bacteriophage point of view, vats should be set as early as possible.

It has been found that a period of 2½ to 3 hours usually elapses between contamination with bacteriophage and stoppage in acid production. Most of the vat stoppages occur in the whey and are the direct result of phage pick-up from the vat as soon as the starter is added.

METHODS OF BACTERIOPHAGE CONTROL.

Two very important phases of bacteriophage control have already been dealt with—namely, starter propagation equipment and technique, and the personal aspect. There are other measures which can be adopted to combat failures due to bacteriophage. In the following discussion they are considered in order of importance.

Cheese Factory Hygiene.

Cleansing and sterilizing methods in cheese factories must be adequate if bacteriophage carryover from day to day is to be effectively reduced. Thorough cleansing is the first requisite since on it depends largely the success of the sterilizing procedures. In Queensland cheese factories, insufficient attention has frequently been paid to the choice of cleansers. Many factories rely on bores for their source of water supply, these bores yielding waters which are frequently very hard and are used without softening. Unless the cleanser used is specially designed to accommodate the hardness, the job of cleansing is made very much more difficult, with the result that it is generally improperly done.

Cheese factories are advised to forward samples of water to the Dairy Research Laboratory for analysis, with a view to determining the most suitable cleansing mixture to be employed. The whole subject is much too comprehensive to be given adequate treatment here, but a general purpose mixture which has been found to give satisfactory results over a wide range of waters is as follows:—

Soda ash	19 lb.
Sodium metasilicate	5½ lb.
Trisodium phosphate	7 lb.
Wetting agent	8 lb.
Water	40 gallons.

This formula will give a stock solution which should be diluted 1 in 32 before use.

Sterilization of equipment is best done immediately after cleansing, when the sterilizing should be by heat, either boiling water or steam or both. The sequence for cleaning and sterilizing is:—

1. Lukewarm water applied as a rinse or flush or by hosing to remove superficial milk and whey remnants.
2. Hot cleansing solution accompanied by brushing. The temperature employed need not be greater than 140°F.-150°F.
3. Boiling water rinse or flushing.
4. Generous application of steam; the contact time should be for at least two minutes.

At one factory a tub of water is kept boiling by slow steam injection. In this tub are immersed the agitators, knives, rakes and brooms to be sterilized. The soundness of this method commends it to notice.

The employment of chlorine for sterilization in cheese factories has become very widespread since it became known that a solution containing approximately 250 parts per million available chlorine gives satisfactory bacteriophage kill. For efficient chlorination, a clean surface and a sufficiently long contact time are required. A contact time of five minutes should be allowed but not greatly exceeded, otherwise metallic corrosion may result. The widespread use of stainless steel has reduced this corrosion to a minimum and has permitted equipment made from it to be chlorine sterilized after cleansing. Tinned copper and tinned steel equipment should be sterilized with chlorine prior to being used only, if corrosion is to be avoided. In the chlorination of cheese vats, best results are probably obtained by using a broom to thoroughly swab the chlorine solution over all vat surfaces.

It must be remembered, however, that chlorine is also bactericidal and can affect the starter organisms. Hence care must be taken to ensure that all remnants of chlorine are removed from the equipment before it is used, by allowing thorough drainage.

Chlorine, in the form of hypochlorites, has also been used in starter room hygiene, where it has been sprayed into the starter room to sterilize the air before the day's subculturing is carried out. Fine atomised chlorine mists are quite effective in ridding the air of bacteriophage particles, but it is doubtful whether spraying of the air in this way can be of any practical advantage. There may be constant re-infection of the air after it has been sterilized and infection of the starters from the operative himself. It is considered that water-seal lids with a filtered air intake furnish sufficient protection for the bulk starter cultures from air-borne phage.

Hygiene in two-shift cheese factories calls for special mention. Where cheese vats are refilled with milk as soon as one lot of cheese is made, there is a constant danger of charging the second vat with large quantities of bacteriophage built up in the first whey. Quick and very thorough cleansing and sterilizing is necessary between the two shifts. Chlorine sterilizing is pre-eminently suitable for this purpose.

Experimental work in cheese factories has demonstrated that cleansing and sterilizing is often inefficiently carried out. This is shown by the relatively high concentrations of bacteriophage frequently found in vats early in manufacture, when no bacteriophage has been detectable in the milk supply or the starter. Such a concentration could result only from equipment pick-up.

Inefficient cleansing has also been noticed with regard to whey tanks, in which considerable quantities of bacteriophage may be carried over from day to day. Whilst a great deal of importance must be attached to whey tank cleansing, there has existed no recognised method of performing it. The practice in many cheese factories of merely hosing out the tank before it is refilled with fresh whey is not satisfactory; it is not very much better than no treatment at all. On the other hand, there are difficulties in the way of proper whey tank cleansing. It should not be made so difficult or unpleasant that the operative will do it satisfactorily only under supervision.

Several methods of whey tank cleansing have been examined. The one that has given the best results has relied on caustic soda 0·5 per cent. and wetting agent 0·2 per cent. as a detergent, which is applied after the

tank has been emptied and rinsed. The cleansing action of the detergent solution is much increased if it is applied with brushing or by pressure circulation. Brushing is not satisfactory in that it necessitates the operative's standing in the caustic in the whey tank, thereby making the job very unpleasant. The better way is to circulate the detergent by pump from a small reservoir and spray it through one or more rosettes over the whole of the internal surface of the tank. Circulation should be continued for 10 to 15 minutes and should be so planned that the whey delivery pipes are included in the circulatory system. Rinsing can be accomplished in the same way.

Rotation of Starter Strains.

Irrespective of the standard of hygiene in a cheese factory, there is always some carryover of bacteriophage from day to day. This occurs largely as the result of whey being splashed about and left on floors, walls, etc.; some phage may also be distributed throughout the factory in the event of it becoming air-borne. If the same starter is used in the factory day after day, there is a progressive build up within the factory of the phage for that starter strain. This build up can be prevented from reaching dangerous proportions by rotation of the starter strains. All strains in the rotation must be separate and distinct with regard to their phage relationships. This means that any bacteriophage occurring in the factory for one strain on any one day cannot multiply thereafter until that strain is used again and as a result would tend to become flushed out of the factory in the intervening period.

In practice the method is singularly successful and is regularly used in a great majority of factories. Various rotations have been employed. The commonest uses 8 strains in a 4-day rotation of pairs. This method possesses the advantage that each day two separate cultures are used in the vat so that should one fail the other would probably persist to carry the manufacture through. It also permits the pairing of strains to give more even working from day to day. Another fairly common rotation consists of 7 strains, one to be used on each day of the week. Whilst this method does not provide the safeguard of two starters daily, it does provide a longer rotation.

The success which has followed the rotation of strains has encouraged the extension of the rotation principle to a further stage—that is, by rotating groups of strains at intervals in addition to daily rotation within a group. This means that a factory would use a group of strains in a daily rotation for a period of one, three or six months, then would change to a completely new set of strains. After using the second group for a similar period, the original group could be brought back into use, or perhaps a third group introduced before the original was used again. The scheme is limited only by the number of unrelated strains available, which number in Queensland is sufficiently large to allow ample use of rotational methods.

The methods of rotation within a rotation would appear to possess advantages additional to those of a simple rotation, for should a bacteriophage population tend to build up steadily despite rotation of strains, this build up would be immediately cut short by replacement of the starter strain group.

Isolated Starter Building.

Useful protection for starter cultures from bacteriophage attack can be provided by isolating the cultures as much as possible from the cheesemaking room and infection from whey. Isolation is practised to a greater or less degree in a majority of factories. Sometimes only the pilot cultures are kept away; sometimes the mother cultures are removed too. The greatest use of the method is made by carrying out all starter propagation work in a separate building completely isolated from the factory. A photograph of such a building is shown in Plate 136.

Plate 136.

An Isolated Starter Building at a Queensland Cheese Factory. The large galvanized iron drum at the extreme right is the filter and sterilizer for air being drawn into the bulk starter cans.

The building is usually located so that prevailing winds cannot carry to it air-borne bacteriophage from the factory or whey tanks. It should be completely equipped with external controls so that the building need be entered as little as possible. Those principles previously outlined regarding contamination from personnel should be rigidly observed by the operative working in the starter building.

Some factories have provided semi-isolated starter rooms or buildings which have been used successfully. Other factories have used water-seal lids with filtered air intakes for bulk cultures in rooms adjoining and opening into the making room and have experienced very few failures despite the absence of protection by isolation.

Experience has shown that the provision of an isolated starter building is not sufficient in itself to bring about complete protection for starter cultures from bacteriophage. The protection it affords is only partial and does little to prevent phage contamination from personnel and faulty propagation techniques.

Ultra-violet Light.

Bacteriophage can be destroyed by ultra-violet light but it is still doubtful whether this fact can be used in practice. Experiments have been carried out to determine the effectiveness of ultra-violet light for the destruction of air-borne phage particles. Under certain conditions, air-borne phage is destroyed within 30 minutes, but it is not known how far from the source of the radiation this destruction persists. At the present time there is no practical use made of ultra-violet light for protection of starters against attack by bacteriophage.

PHAGE-RESISTANT STARTER CULTURES.

Throughout the article emphasis has been placed on methods of starter management designed to keep phage out of starter cultures, and these methods have been applied with success over the last decade. However, there exists an alternative method of starter maintenance which relies on the development of phage-resistance in a culture. In this method, the admission of phage into culture is allowed and is actually sought after in the case of mother cultures. It has been used successfully in some Queensland factories for several years.

MANUFACTURING METHODS FOR PHAGE VATS.

Vat failures due to bacteriophage may occur at any stage of the manufacturing process up to and including early cheddaring, although they are most common when the curd is in the whey. Experience shows that failures do not occur after the early cheddaring is completed, or in other words after a three-hour period has elapsed following cutting. When considering the treatment to be applied to vats which have ceased to make acid, it is convenient to divide them into three groups:—

1. Vats which do not commence to make acid.

2. Vats in which acid production stops in the whey.

3. Vats which stop after the whey is run.

Vats in which acid production does not commence normally.—It is possible, though very uncommon, for a starter to fail to commence making acid. When this occurs, the starter has probably become phaged in the bulk starter stage, even though it may have clotted before being attacked. Such a stoppage is very like the typical behaviour of a penicillin vat and it would be most difficult for the cheesemaker to differentiate between the two. In an attempt to alleviate the position, it may be possible to procure a quantity of additional starter and add it as soon as possible. At this stage, even half a gallon of starter is very valuable and may be obtained from the various mother cultures carried, ignoring the one which was used in the vat. Otherwise little can be done but wait for acid development to commence.

Vats in which acid production stops in the whey.—Failures of this type are by far the most common, the starter having picked up phage on being added to the vat. Acid production stops some 2½-3 hours later, usually in the whey. It is recommended in such cases that the cheesemaker wait as long as he is able for acid production to commence

again, which it will inevitably do. The length of time he can afford to wait depends on the initial quality of the milk and the resultant quality of the curd as it is held in the whey. Undesirable flavours might well be the limiting factor. Approximately 3½ hours in the whey has been found to be the usual safe time which can be permitted before the curd shows evidence of becoming whey-soaked. The whey should be run to the top of the curd and the curd well shaken. This will assist in reaching the running-off acidity. Thereafter, once it has commenced again, acid production can be expected to progress fairly well throughout cheddaring.

When the vat stops prior to wheying off, some cheesemakers prefer to "Yankee" the curd instead of cheddaring. The method adopted is more applicable to good milk and is as follows:—

The cheesemaker is advised to wait as long as he can for acid production to commence again. When it reaches say .25%, the whey is run down to the top of the curd. The curd is then stirred gently in whey until the acidity advances to about .33-.35%. The whey is then run completely and the curd well stirred to dryness until the acidity reaches about .40%, after which the curd is salted without cheddaring. Salting should be at the rate of 2.5 to 3% and hooping should be quickly done.

Vats which stop after the whey is run.—Here again it may be necessary to wait some time for acid production to commence, but useful assistance can be given by dry stirring the curd. The curd should be kept warm at all stages and when finally milled should be well shaken before and after salting.

It is most important to pay increased attention to cleansing and sterilizing of the vats following a failure. On no occasion should the same starter be used in the vats on the following day.

PENICILLIN AND OTHER ANTIBIOTICS.

Although the main cause of starter failures is contamination with bacteriophage, there are some instances in which bacteriophage has been proved to be absent and cannot be blamed for slow vats.

Trials made in this State have confirmed overseas work that excessive penicillin in milk will inhibit starter growth. Under the conditions of trial a concentration of penicillin equivalent to one unit per millilitre of milk constitutes what would appear to be the critical level, though the experienced cheesemaker could probably detect slowness resulting from slightly lower concentrations. This concentration in the milk could only be reached when very large numbers of cows are undergoing treatment, so that vat failures from this cause are not likely to occur very frequently. There have been, however, numerous instances when it is known that the factory itself has vended very large amounts of penicillin to its co-operative suppliers for mastitis treatment, and where this has been followed by slow vats not due to bacteriophage, penicillin is suspect.

Penicillin usually results in characteristic vat behaviour which is distinct from that caused by bacteriophage. Penicillin attacks the starter fairly quickly and will result in slowness to reach setting acidity. After a time the suppressive effect may lessen slightly and

acid production becomes a little faster. A bacteriophage vat, on the other hand, usually works normally for a time until bacteriophage multiplication reaches the critical level, when acid production ceases.

It is recommended that dairy farmers exercise care in the disposal of milk drawn from freshly treated quarters. At least the first milk drawn from each quarter, following treatment, should not be included in the bulk forwarded to the factory.

Penicillin serves as a common example of substances which are known to occur fairly frequently under natural conditions. They are called antibiotics because they are produced by one organism and are antagonistic to others. It has long been known that mastitis milk is antagonistic to starter cells in the cheese vat. It has been shown also that some species of coliforms may be inhibitory in their action. In addition, English workers have isolated a streptococcus, somewhat similiar to the starter organism, which is most powerful in its starter suppressing effect. This phenomenon does not cease here, for some starter strains are known to be antagonistic to others, giving an incompatibility between these strains.

It will be seen that the problem of slow vats in cheese manufacture is a very complex one and cannot always be explained in terms of bacteriophage.

A Labour Saving Concentrate Feeder.

P. McCALLUM, Senior Dairy Adviser.

THE feeding of a ration of grain and concentrates to milking cows while passing through the milking bail is a growing practice amongst dairy farmers, particularly those supplying the whole milk trade. It is profitable to feed a ration of concentrates for the greater part of the year on many milk producing farms. While the full feeding of cows in the milking bails is not a desirable practice, due to the dust created from the feed and the upsetting of the cows on some farms, it is not within the reach of many farmers to erect separate feeding stalls and so feed before or after milking.

The methods employed in feeding cows in the bails are many and varied. With the accent today on labour saving devices in the milking shed, a feeder that should prove popular with dairymen is one devised by Mr. J. O. Windsor, Homebush Road, Mackay. Mr. Windsor has many labour saving devices in his milking shed, in which all bail units are of all-metal construction and made to his own design. His cows leave the bail to enter the exit race by side gates which help to form the "dummy" bail, and not by the more popular straight walk-through method.

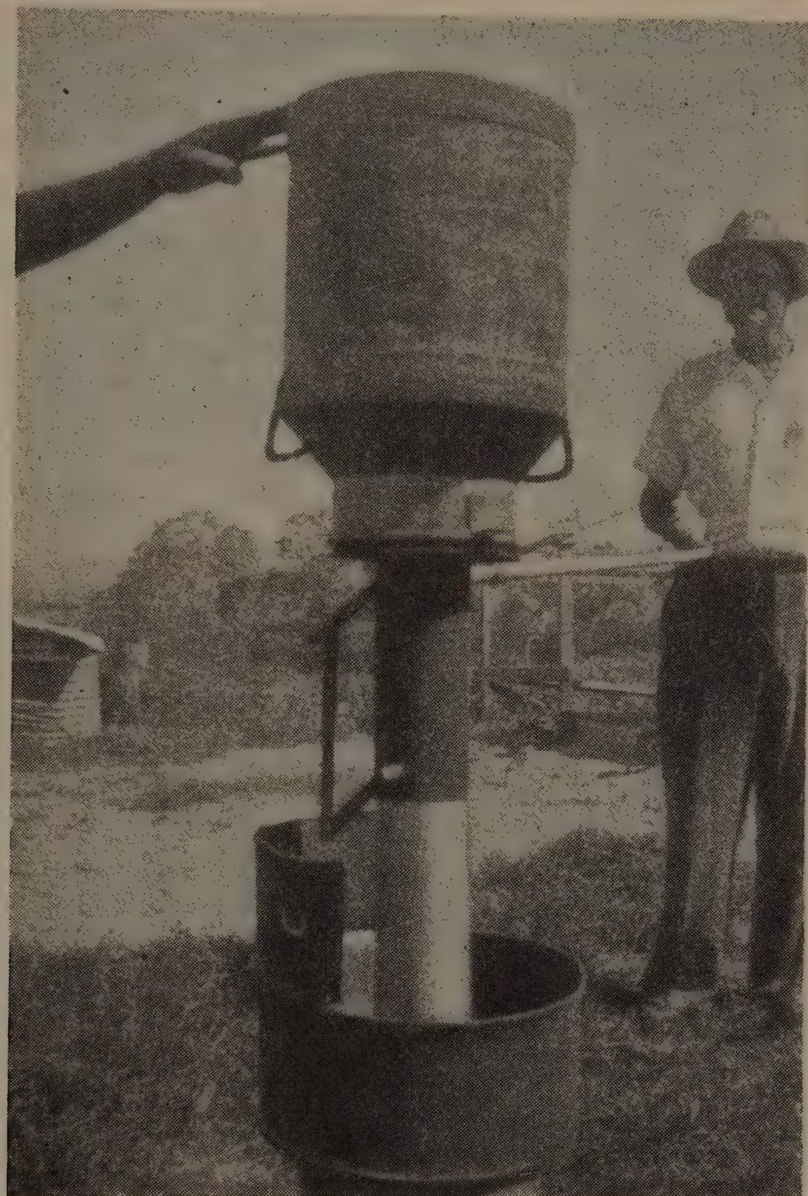


Plate 137.
General View of Concentrate Feeder.

To enable him to give each cow a ration of grain and concentrates with the least possible fuss and labour, Mr. Windsor designed a feeder which is cheap and efficient. As will be seen from Plates 137 to 140, the bulk containers for holding the concentrates are old 10-gallon milk cans. These were purchased for 10s. each from the local factory. The cans have had the bottoms removed to allow them to be filled, and are suspended above the head of each bail unit. A hole four inches in diameter was cut out of the centre of each can lid, and a section of old bore casing welded to the lid. The inside of the lid has been shaped like a cone by welding a piece of flat iron around the inside of the lid. This causes the feed to run freely into the mouth of the chute.

Into the chute, or bore casing, have been fitted two butterfly valves which control the flow of the feed. When one valve is open, or in the vertical position, the other valve is closed, or in a horizontal position, and vice versa. The two valves are connected by a connecting rod, which can be clearly seen in Plate 137.

The operation of the valves is controlled by a metal handle attached to the top valve. This handle extends from the feeder back to a point below the fascia board carrying the milk line of the milking machine. It is of $\frac{3}{4}$-inch piping and has a right angle bend on the end to form a hand grip. A quarter turn opens and closes the valves.

The distance between the two valves is nine inches, but could be varied to suit farm conditions. The valve axles are welded to two 3-inch rods which form an elbow joint and are attached to the vertical 9-inch connecting rod by means of a small bolt at each end. The dimensions are shown in Plate 140.

The length of the chute will be governed by the height of the bulk can and the height of the feed trough from the floor. Mr. Windsor had an extension for the chute made of galvanised iron, and this can be plainly seen in the photographs. The upper section of the chute could not be made of galvanised iron, as the axles for the valves would soon split the iron. The galvanised iron extension is not necessary and the whole of the chute could be made from the bore casing. The feed tins are cut-down 12-gallon oil drums and are swung on one of the metal pipes at the head of each bail.

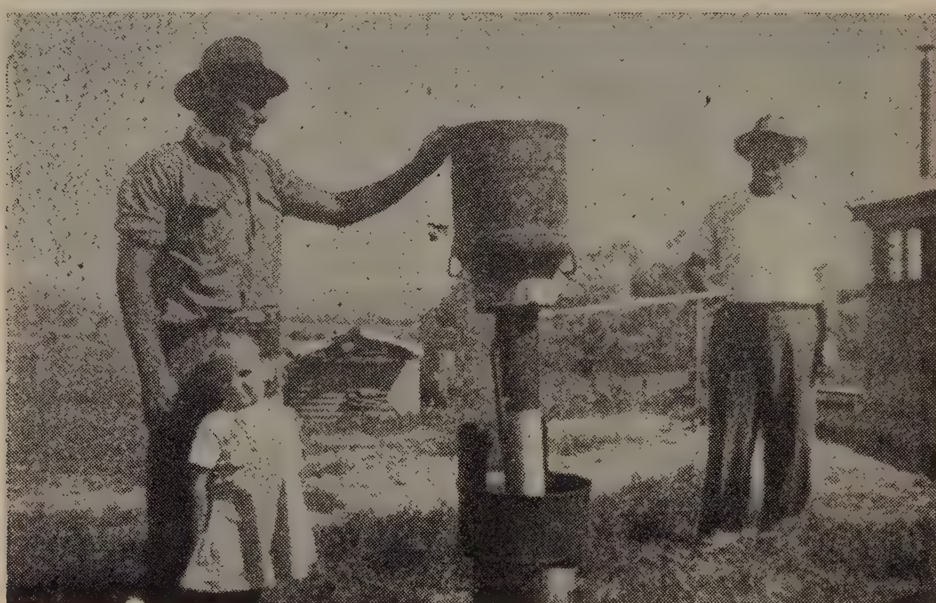


Plate 138.
Feeder with Chute Closed.

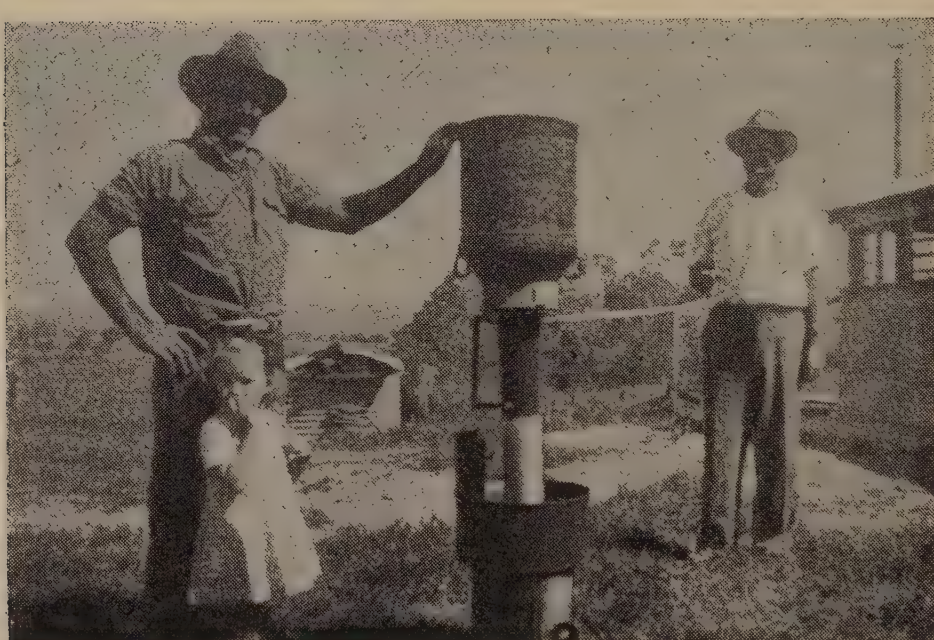


Plate 139.
Feeder With Chute Open.

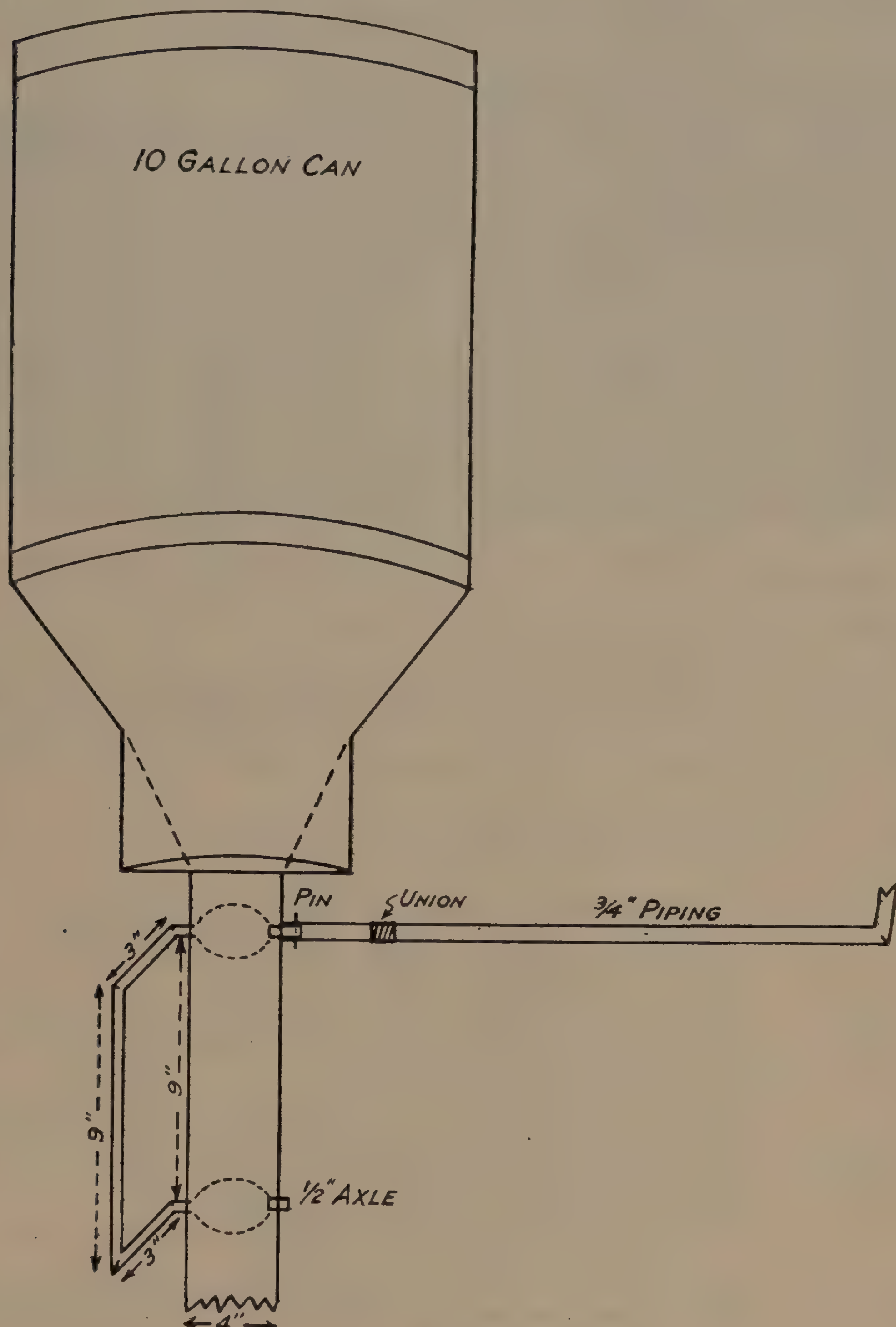


Plate 140.
Sketch of Concentrate Feeder.

The cost of each feeder was £4. This covered the welding of the lids, the making and fitting of the valves, and the connecting rods.

The amount of grain or concentrates delivered through the chute is governed by the distance between the two valves and the diameter of the chute. In Mr. Windsor's case the chute delivers about 1½ lb. of bran and pollard at each operation, and about 2½ lb. of a mixture of maize meal and grain sorghum. To feed a lesser amount the valves need not be opened fully and this prevents the full measure from falling down the chute into the feed bin.

After having been in operation for six months, the feeding device is working well and Mr. Windsor is quite satisfied with it.

TUBERCULOSIS-FREE CATTLE HERDS.

(AS AT 13th OCTOBER, 1952.)

Breed.	Owner's Name and Address of Stud.
Aberdeen Angus ..	The Scottish Australian Company Ltd., Texas Station, Texas F. H. Hutton, " Bingegang," Dingo
A.I.S...	F. B. Sullivan, " Fermanagh," Pittsworth D. Sullivan, " Bantry " Stud, Rossvale, *via* Pittsworth W. Henschell, " Yarranvale," Yarranlea Con. O'Sullivan, " Navillus Stud," Greenmount H. V. Littleton, " Wongalea Stud," Hillview, Crow's Nest J. Phillips and Sons, " Sunny View," Benair, via Kingaroy Sullivan Bros. " Valera " Stud, Pittsworth Reushle Bros., " Reubydale " Stud, Ravensbourne H. F. Marquardt, " Chelmer " Stud, Wondai W. G. Marquardt, " Springlands," Wondai A. C. and C. R. Marquardt, " Cedar Valley," Wondai A. H. Sokoll, " Sunny Crest " Stud, Wondai W. and A. G. Scott, " Welena," A.I.S. Stud, Blackbutt G. Sperling, "Kooravale" Stud, Kooralgin, via Cooyar
Ayrshire	L. Holmes, " Benbecula," Yarranlea J. N. Scott, " Auchen Eden," Camp Mountain "St. Christopher's and Iona" Studs, Brookfield Road, Brisbane E. Mathie and Son, "Ainslie" Ayrshire Stud, Maleny
Friesian	C. H. Naumann, " Yarrabine Stud," Yarraman
Guernsey	C. D. Holmes, " Springview," Yarraman A. B. Fletcher, Cossart Vale, Boonah
Jersey	J. S. McCarthy, " Glen Erin Jersey Stud," Greenmount J. F. Lau, " Rosallen Jersey Stud," Goombungee G. Harley, Hopewell, Kingaroy Toowoomba Mental Hospital, Willowburn Farm Home for Boys, Westbrook F. J. Cox and Sons, " Rosel " Stud, Crawford, Kingaroy Line R. J. Browne, Hill 60, Yangan P. J. L. Bygrave, " The Craigan Farm," Aspley R. J. Crawford, " Inverlaw Jersey Stud," Inverlaw, Kingaroy P. H. F. Gregory, " Carlton," Rosevale, *via* Rosewood E. A. Matthews, " Yarradale," Yarraman A. L. Semgreen, " Tecoma," Coolabunia G. & V. Beattie, " Beauvern," Antigua, Maryborough L. E. Meier, " Ardath " Stud, Boonah A. M. and L. J. Noone, "Winbirra," Stud, Mt. Esk Pocket, Esk W. S. Conochie and Sons, "Brookland" Stud, Sherwood Road, Sherwood
Polled Hereford ..	W. Maller, " Boreview", Pickanjinnie

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Maize-Growing in the South Burnett.

A. C. ARVIER, Assistant Agronomist, and H. S. PINK, Adviser (Soil Conservation).

BY virtue of its climate and major soil types, the South Burnett district is better suited for summer than winter cropping. For this reason, coupled with the fact that summer rainfall is normally adequate for good maize yields, this crop has always been the major grain crop of the district. In keeping with that of most other commodities, since World War 2 the price of maize has risen steadily and, notwithstanding increased costs of production, the margin of profit has remained satisfactory. The recent development of hybrid maize has increased the yield potential and thus further enhanced the popularity of the crop.

Table 1 shows the annual area and production of maize in the South Burnett for the period 1940 to 1950 (excluding 1941, for which season the data are not available). Over this period the district contributed some 23% of the total Queensland area sown to maize, and some 23·8% of the total Queensland production. For the same period the mean South Burnett yield was 25·0 bush. per acre as compared with the State mean of 24·1 bush. per acre.

TABLE 1.

AREA AND PRODUCTION OF MAIZE IN THE SOUTH BURNETT DISTRICT FOR THE PERIOD 1940 TO 1950.

Harvest Year.	Area Sown.		Yield.	
	Acres.	Percentage of State Total.	Bushels.	Percentage of State Total.
1940	41,646	20·3	1,047,698	23·6
1941	*	*	*	*
1942	37,637	21·7	823,182	21·7
1943	38,949	22·6	981,021	21·7
1944	37,345	23·6	954,495	24·7
1945	33,603	24·6	813,501	28·4
1946	32,063	22·7	634,944	21·6
1947	28,570	22·4	817,686	23·5
1948	19,871	20·4	399,441	16·3
1949	29,130	25·2	924,318	27·2
1950	32,629	29·0	879,216	29·0

* Not available.
Data from Government Statistician.

The present trend in acreage appears to be upward, the estimated area for the 1950-51 season being approximately 50,000 acres out of a State total of some 125,000 acres. It is estimated that during the drought season of 1951-52, some 30,000 acres may have reached maturity in the South Burnett, out of a State total of about 90,000 acres.

Plate 141.

A Maize Crop at Crawford, near Kingaroy.

Plate 142.

Close-up of a Maize Crop at Kumbia, south-west of Kingaroy.

In the South Burnett, maize is used in a number of ways. For the most part it is grown for the yield of grain, much of which is consumed on the farm by dairy stock, pigs and poultry. Of the grain sent out of the district, a large proportion finds its way south to the manufacturers of "cornflakes" and other breakfast foods. While it is not uncommon to find maize-growing for grain a sole means of livelihood, especially on the larger farms, it is much more usual to find maize grown in conjunction with dairying and pig-raising.

To a lesser extent maize is grown for fodder purposes. It can be cut and fed as "chop-chop" at virtually any stage before the silks dry out completely, while excellent silage can be made in the later stages of flowering, preferably before the grain has developed beyond the "dough" stage. It sometimes happens that extreme heat at tasselling time causes a material reduction in the extent to which grain is set, due to heat-induced sterility of pollen. A crop which has failed for grain under these circumstances can be used as green fodder or converted to silage, and the prospect of a complete loss avoided.

In recent years the popularity of hybrid maize has steadily increased. Not only does the prospect of a higher yield attract the attention of most farmers, but the additional features of uniform plant habit, regular cob height and better husk cover are all regarded as very desirable improvements over open-pollinated material. Specific hybrids are not recommended for a district until they have consistently yielded better than the most favoured local variety by at least 15%. A list of these hybrids at present recommended for the South Burnett is found under the appropriate heading later in this article.

DISTRICTS AND SOILS.

Within the South Burnett there are several maize-growing areas, the most important of which is Memerambi-Wooroolin, closely followed by Kumbia-Manneum and Edenvale-Coolabunia. This statement does not necessarily reflect soil fertility, but rather density of settlement, for good maize-growing areas are found throughout the South Burnett wherever the better classes of soils occur.

The heavy black clays bordering Barambah and Barker's Creeks, the brigalow-belar and silver-leaf ironbark black soils, the brown, chocolate and red "scrub" clay loams, and the red "forest" loams and clay loams, all grow good maize. In the better seasons quite satisfactory crops have also been taken from the grey loams which carried open "forest" of grey box and ironbark.

PLANTING AND CULTIVATION.

In the normal course of events maize will grow quite satisfactorily on the soils described above, provided reasonable summer rains occur. In a normal year three-quarters of the average yearly precipitation of 28 inches falls between November and May, with the peak extending over the December-January-February period. Short breaks of very hot, dry weather frequently occur during these summer months, thunderstorms usually providing the rain.

Bearing this in mind it is not difficult to appreciate the general recommendation that maize be planted not earlier than the beginning of December. In certain favoured localities, October and November plantings are often made, but such crops are frequently subjected to

the hot, dry periods referred to in the previous paragraph and poor grain setting may result. It has, however, been the experience of growers that, where recommended hybrids are grown, tasselling during heat-wave periods is not associated with pollination failures. This fact may well extend the maize-planting period as hybrids increase in popularity.

The requirements of maize in respect of seed-bed preparation, planting and subsequent cultivation are sufficiently well known not to require repetition in detail. The main feature of proper seed-bed preparation is weed destruction, combined with a reduction of the physical state of the soil to a reasonably fine tilth. The surface-mulching of any green-manurial crop or volunteer weeds and rubbish should precede planting by a sufficient length of time to permit proper decomposition of the organic matter.

In the actual planting operations, various methods are followed. In this mechanical age the use of tractor-drawn, four-row planters is almost universal, but there are still to be found a few of the old two-row, horse-drawn planters which satisfactorily perform the same task. The gears are usually adjusted to plant 7–8 acres to the bushel of seed, with row spacings between 3 ft. and 4 ft. With the narrower row spacings it is preferable to drop the seed less frequently, thereby maintaining the same density per acre.

FERTILIIZERS.

Given favourable seasons, excellent crops of maize are produced on most of the South Burnett soils without the use of artificial fertilizers. This statement applies particularly to farms on which sound rotation systems have been practised and erosion hazards have been avoided. As a result, it is not usual for farmers to apply fertilizers when planting maize. However, interest in the application of fertilizers, particularly on old maize land in the "forest" areas, is increasing and a number of farmers now make it a yearly practice to fertilize portion of their properties on a rotational basis.

While the results of recent fertilizer trials have not shown any clear-cut general trends, there is evidence to suggest that superphosphate will give responses on older cultivations. On some of the red "forest" soils and on areas where erosion has occurred, a mixture of superphosphate and sulphate of ammonia has proved to be of greater benefit than superphosphate alone.

When applying superphosphate to any of the red volcanic loams, it should be remembered that these soils have a tendency to "fix" the soluble phosphate and make it unavailable to plants. For this reason the superphosphate should be drilled in a narrow band with the seed, and not applied broadcast. Sulphate of ammonia may be drilled in at planting time or applied later as a side-dressing to the young crop.

Soils used for maize are normally slightly acid in reaction and do not require lime or dolomite. However, there are many areas where erosion has occurred and the more acid subsoil has been exposed. In such cases, applications of lime or dolomite are likely to prove beneficial.

CULTIVATION AND SOIL CONSERVATION.

Owing to the undulating topography of the country, the nature of the soils, and the periodical risk of severe thunderstorms, good farming practices and special conservation measures are required if the ravages of soil erosion are to be avoided.

Crop rotations designed to maintain the fertility and structure of the soil are as important with maize as with any other crop, and form the basis of the approach to any soil erosion problem. A good crop rotation (for any cultivation land) includes retirement of the paddock to grass for a period of at least three years in 10, and the use in the cropping programme of legumes such as cowpeas and navy beans. Grain sorghum, maize and fodder crops could make up the balance of the 10-year rotation period.

As with other crops, the method of preparing the soil for maize-growing has an important bearing on the incidence of erosion. It is advisable to leave the soil in a rough condition as long as possible, as severe storms are usually experienced during preparation of the ground. The retention of all crop residues on or near the surface of the soil gives added protection, and to this end the use of tined implements such as the scarifier is becoming increasingly popular. Final preparation should be designed to give as complete a surface mulch as possible.

The construction of physical barriers is usually necessary, particularly where topsoil has been removed by previous erosion. These barriers hold and, if need be, divert water which cannot be readily absorbed in the soil. These mechanical measures include pondage or diversion banks (to protect cultivation paddocks from outside run-off water), and contour banks placed at intervals down the slope. The latter are designed to lead surplus water slowly across the paddock into prepared waterways or natural drainage lines.

The contour cultivation used in conjunction with contour banks assists the absorption of water. The hilled maize rows also become miniature dams which must be filled before any surplus water will start to flow.

The solution of the soil erosion problem lies not in the application of any one measure, but in a combination of sound commonsense practices which have already been proved in this district.

WEED CONTROL.

In most cases inter-row cultivation is sufficient to kill the majority of weeds which germinate with the maize seed. If for some reason the weed growth becomes excessive in the rows, it may be practicable to substitute sweep blades for tines on the scuffling equipment. This will give a hilling action, which has the effect of smothering weed growth. As the crop increases in height, inter-row cultivation should be carried out at progressively shallower depths in order to minimise injury to the very fine roots. Only in exceptional circumstances should maize be cultivated after reaching about three feet in height.

With most weeds other than grasses a popular method of control today is by the agency of selective chemical weedicides of the hormone type. These weedkillers are selective for a large range of broad-leaved plants when sprayed at appropriate dilutions, while members of the grass family (such as maize) are not unduly harmed. Moderate to heavy infestations of Noogoora burr, stagger weed, bellvine, pie melons and similar troublesome weeds may often be controlled by hormone spraying at much less cost than physical cultivation.

HARVESTING.

Maize is still harvested by hand on many farms throughout the district, particularly where smaller areas are involved. The normal procedure is to snap off the cobs by hand (without husking), and throw them into a dray or other farm conveyance which accompanies the pickers up and down the field. Such cobs should be stored in a well-ventilated shed or barn to await shelling.

With the advent of more efficient picking machinery, there has been a steady increase in the area machine-harvested over the past few seasons. Single-row, towed machines and double-row, mounted machines are now to be found fairly evenly distributed in the district. A number of local operators have found it necessary to make adjustments to their machines because of the loss of shelled grain, normally from too much tension in the rollers. Apparently the machines were originally designed to pick maize in a somewhat less mature condition than that to which local growers are accustomed. Slackening the tension and substituting plain-surfaced rollers are adjustments which normally correct the fault mentioned.

Mechanical pickers usually do no more than strip the cob from the stalk and convey it by adjustable elevator to a wagon, towed behind. This method of harvesting is found to suit local conditions, as it allows maize to be picked when not quite fully mature. Storage in crib or barn may then follow with much less risk from weevils or birds than if the crop were allowed to mature fully in the field.

The final phase of the harvesting operation is that of husking and shelling. In a few cases shelling with a hand-sheller is still practised, but this applies only to small areas. This process is slow and laborious, and requires prior husking of the ears by hand. Combined husking and shelling is usually carried out by semi-mobile, belt-driven machines which are moved from site to site as required. Capacities may vary from 15 to 50 bags of grain per hour, one popular make in extensive use being capable of delivering 30 bags per hour.

In some cases complete harvesters have been built by the addition of husking and shelling machinery to mechanical pickers. This type of machine is not widely used, however, as it requires the maize to remain in the field until it is fully mature. Losses may then occur, not only from bird and weevil attack in the field, but also from cobs shaken from the dried-out stalks by the vibration of the picker. Under certain circumstances it may be profitable to follow such a picker on foot in order to recover the dropped cobs.

STORAGE.

As most maize, particularly machine-picked maize, is harvested prior to full maturity, some storage in a crib or barn is necessary to allow the cobs to dry out prior to shelling. It is not unusual for such preliminary storage of cobs in the husk to extend over a period of weeks or even months. Maize in the husk is reasonably well protected from weather, and to some extent from insect attack. However, rodent control is a feature which requires attention, and preventive measures should be taken as early as possible, preferably during the construction of the buildings.

Subsequent storage falls into two categories, according to whether the grain is required for feed or for seed; conditions of storage vary accordingly.

Where short-term storage of feed maize is intended, cobs may be left in the husk and simply shelled as required. Where long-term storage is necessary, the grain should be shelled and tanked. For this purpose, ordinary 1,000-gallon tanks fitted with airtight delivery spouts and manhole covers are commonly used; each such tank will hold 125 bushels of grain. Maize so stored must be sound, dry and weevil-free. Unfortunately, the last requirement cannot be guaranteed, so that fumigation with carbon bisulphide is almost invariably necessary. If the tank is filled with grain and is perfectly gas-proof, no more than a quart of the fumigant is necessary for this capacity. Exposure to the air for a few hours is all that is necessary prior to feeding such grain to stock. Carbon bisulphide is a poison. Moreover, when the gas mixes with air it forms a highly explosive and inflammable mixture. Great care should therefore be taken when using this chemical.

Maize grain intended for planting in the subsequent season was formerly stored under similar conditions. However, with the recent introduction of seed dusting with benzene hexachloride (BHC), seed storage has been considerably simplified. BHC is highly effective against weevils, and there are now on the market several proprietary lines which may be used for this purpose. The recommended rate of application is 3 oz. per bush., using a dust containing 1% of the gamma isomer of BHC. This rate should not be exceeded, nor should treated grain be exposed to direct sunlight. Treated grain should not be fed to poultry or stock because of the risk of flesh taints, if not actual poisoning.

While BHC cannot be recommended for the protection of shelled grain intended for feed, it can be used quite effectively where such grain is stored on the cob, unhusked. An even sprinkling of BHC dust throughout a heap of cobs in a barn or crib will materially assist in preventing insect infestation, without actually coming into contact with the grain. Shelling of the grain for feeding or for sale may then take place at the farmer's convenience.

It is of interest to record the apparent success of BHC in rodent control. Handfuls of dust scattered between stacks of bagged grain will apparently do much to reduce rat and mouse damage, but it is doubtful whether this is due to anything more than the repellent effect of the unpleasant odour of the chemical.

VARIETIES SUITED TO THE SOUTH BURNETT.

Prior to the testing and release of hybrids in the immediate post-war years, the greater portion of the maize produced was grown from local seed of open-pollinated varieties. Yellow varieties have predominated, but there has always been a proportion of white maize grown, mainly for processing into "cornflakes" and similar breakfast foods. Of the yellow strains, Improved Yellow Dent and Fitzroy have maintained the most popular place, followed closely by Early Leaming and the so-called Ninety-Day. Manning White and Hickory King are the more important white varieties.

Since the war there has been a progressive release of Queensland-bred hybrids by the Seed Certification Committee, and those which have proved themselves sufficiently superior in yield trials are now widely grown throughout the district. The paramount advantages of

uniformity in habit and maturity, and a higher yielding ability compared with "local" varieties, have appealed to most growers. It was estimated that in the 1950-51 season half of the 50,000 acres planted was sown to hybrids, and it is confidently expected that the ratio will gradually improve.

So far there are only six hybrids specifically recommended for the district, but the list is not static. New hybrids are being evolved and tested by the parent breeding establishment at the Queensland Agricultural College, and in time still better hybrids may be available to supplant some of those in general use today. At the time of writing the order of preference stands as follows:—

Q23.—This hybrid, which matures in 5½–6 months, suckers more than the average, and is fairly leafy. The average height is 9–10 ft., and it is equally suited to scrub and forest soils. It has good root and stalk strength, the only weakness being that some stalk-breaking may occur at maturity. The ears are carried rather high on a slightly long shank and the grain is yellow to reddish-yellow in colour. The grain, sometimes a little dull, has a moderate crease, and is inclined to be starchy. The cores are of moderate thickness, and grain depth is satisfactory. It is probably the best general-purpose hybrid for use in the South Burnett district.

Q692.—A long-term hybrid which matures in 6 months, and has a moderate amount of suckering. The average height is 9 ft. and the plants are erect and fairly leafy. The husk cover is a little short, but ears hang down well at maturity. Ear height is satisfactory and the grain colour is yellow with a slight reddish tinge. The crease is average and rows are somewhat open. The grain is very slightly starchy but bold and of fair depth.

Q716.—This hybrid takes 5–5½ months to mature, has vigorous plant growth, stands up well to adverse conditions, and is not susceptible to lodging. Plant height averages 8 ft. The husk cover is somewhat short and loose, but the ears hang down well at maturity. The heavy ears are of deep-orange colour. The grain is of good lustre, fairly hard, of medium depth, and inclined to be slightly peg-tooth-shaped with a medium dent.

Q739.—An early hybrid which matures in 4½–5 months. It is hardy, has sturdy stalks, and a good root system. The husk is good and the ears hang down at maturity. The ears are heavy; the grain is yellow, bright, of good-medium quality, and is only slightly shallow. The shanks break easily and cleanly at harvest.

Q629.—This is a hybrid of 5½-6 months maturity, not particularly leafy, with only slight suckering. Height is about 9 ft. Plants are fairly erect, and there is a slight tendency to lodge. Husk is somewhat short, but the ears, which are carried a little high, hang down at maturity. Ears are typically 8 in. long, more or less cylindrical, with slightly open rows which are not quite regular. The grain is yellow, slightly starchy, with only a moderate crease, and is somewhat susceptible to weevil attack.

This variety may be replaced shortly by more suitable types, in which case it will go out of cultivation in the South Burnett.

Q431.—This hybrid is of 5½–6 months maturity, is not particularly leafy, and the suckering is only moderate. The stalk height is 9 ft. On rich red scrub soils the stalks tend to break at maturity, although on forest soils this defect is not apparent. Leaves are slightly long, and 60–70% of the ears turn down at maturity. Ears are borne a little high. The grain is yellow in colour with a bright lustre and a moderate crease.

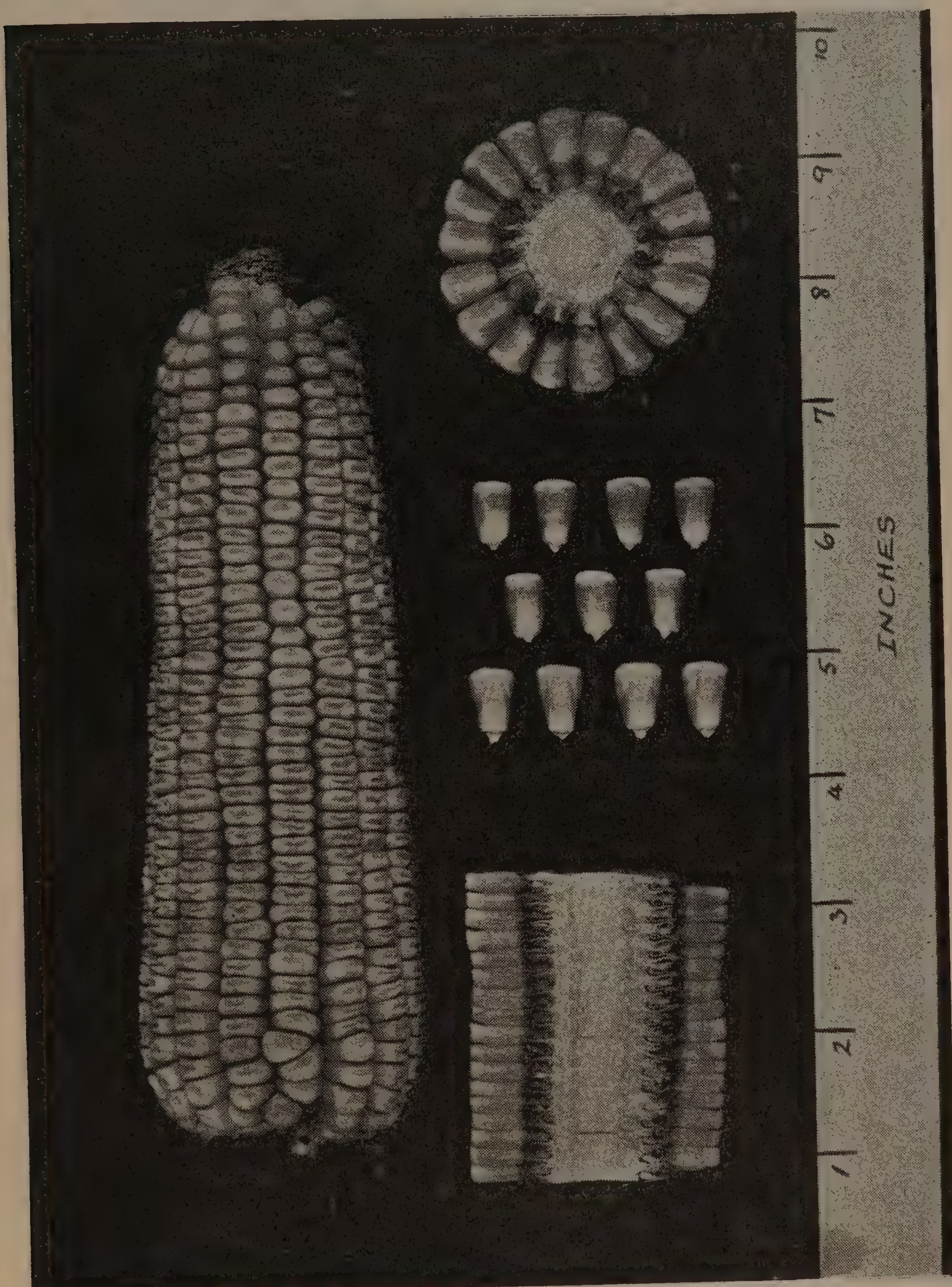


Plate 143.

Hybrid Q23. The whole and sectioned cobs carried yellow grain, while the lowest row of shelled grain was of a reddish tint; this variability in grain colour is typical of Q23.

Q719 is a seventh strain which is showing distinct promise and is coming into favour. It is a 5½–6 months hybrid which has the ability to set ears at a very uniform and convenient height, and is therefore well suited to mechanical picking.

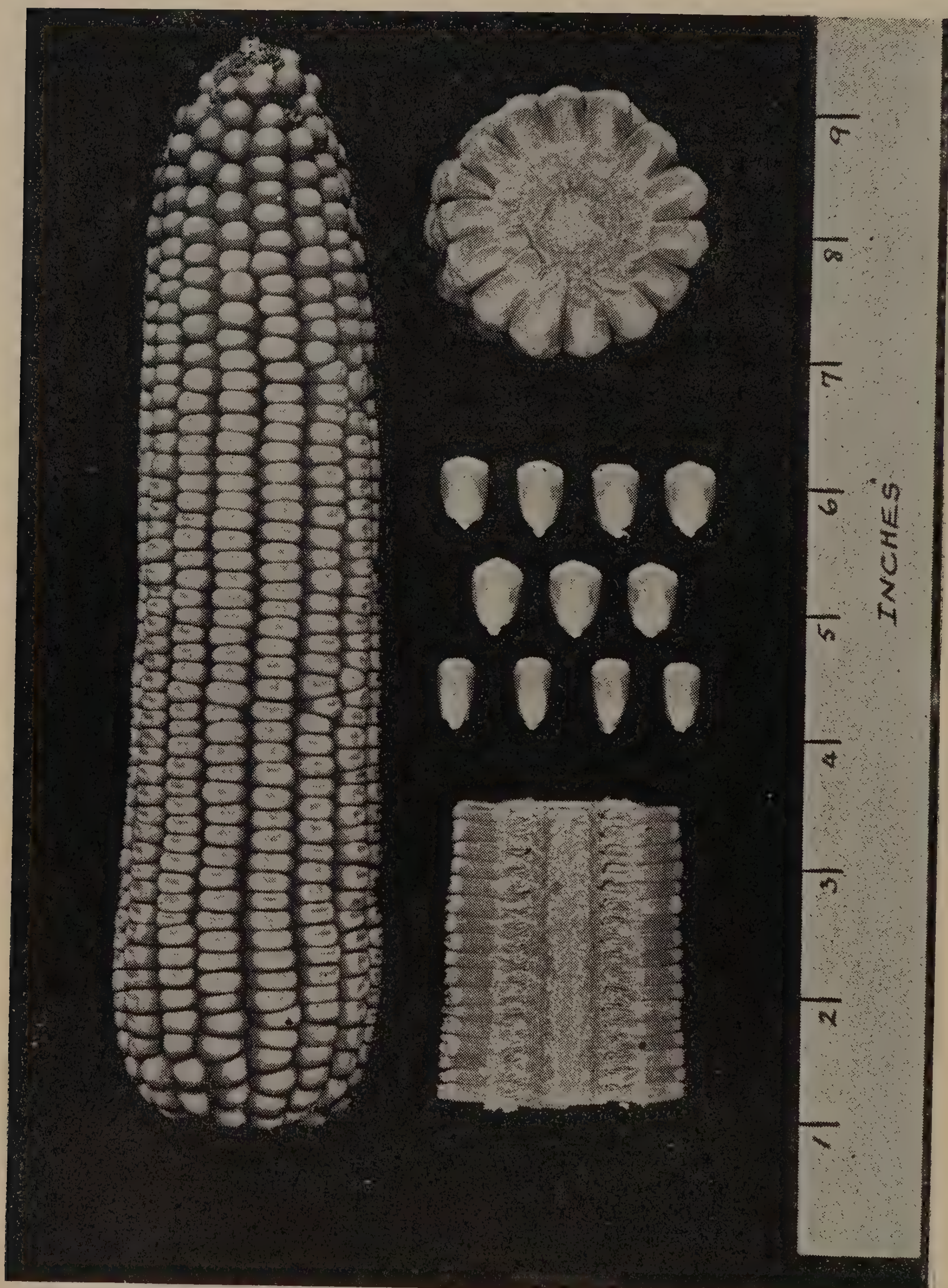


Plate 144.

Hybrid Q692. This hybrid also produces a proportion of grain with a reddish tinge; some variability in grain shape is also shown in the photograph.

While not specifically recommended for the South Burnett, there are several additional hybrids which may in time be included in the above list. They are:—

Q658, a mid-season strain, at present only recommended for the South Coast (Logan and Albert Valleys).

Q440, an early hybrid similar to *Q739*.

Q526, a late hybrid with grain characters similar to *Q431*.

Q724, another early strain at present only recommended for the Darling Downs.

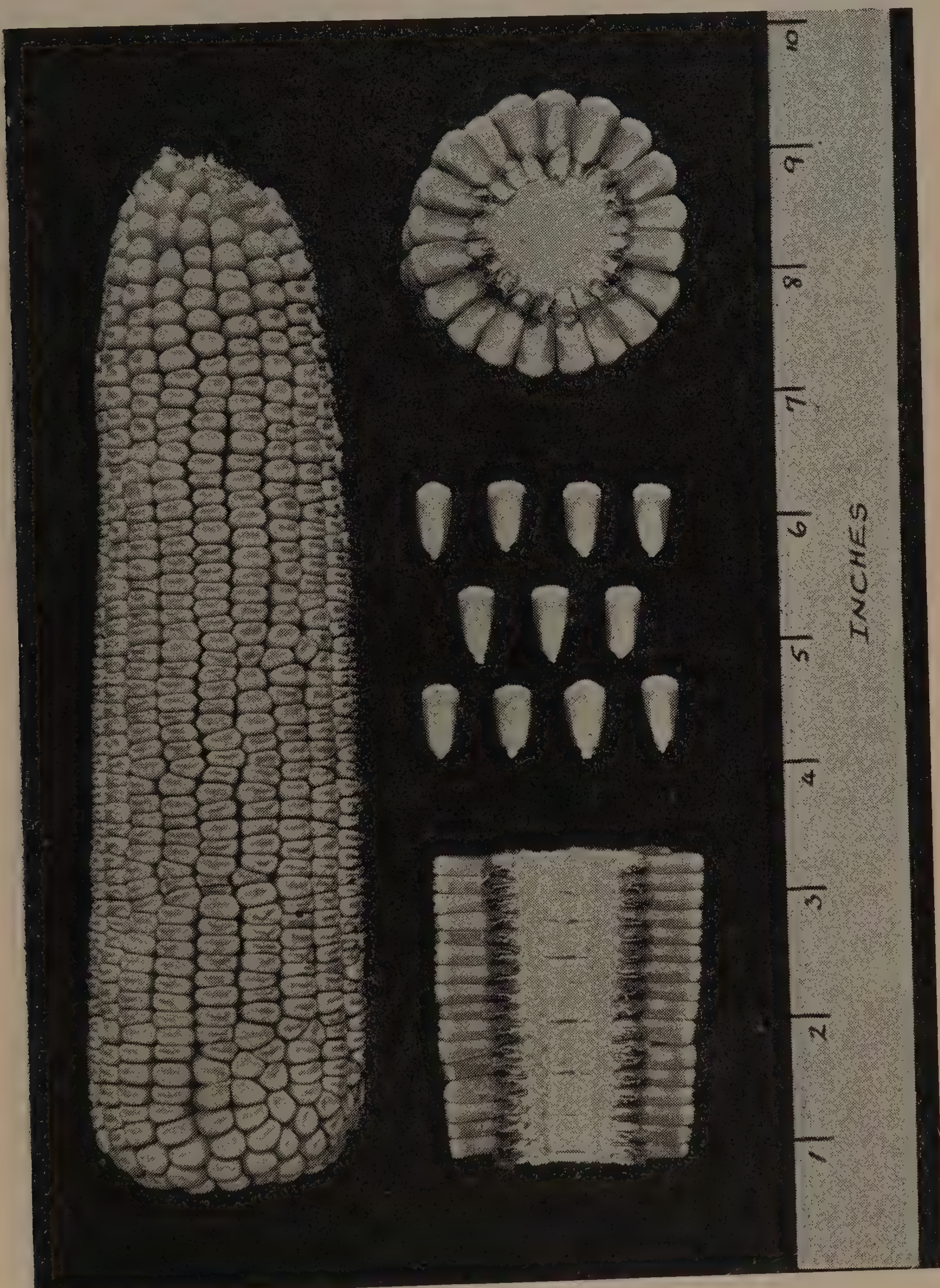


Plate 145.

Hybrid Q716. A mid-season hybrid with uniformly yellow grain.

The above recommendations are not made without the guarantee of experimental evidence. Hybrids have definite limitations in respect of soil types and climatic conditions, and those recommended for the South Burnett will not necessarily do well elsewhere. The reverse also applies, and growers should treat with reserve any oral recommendations not verified from an authoritative source. Areas recommended for

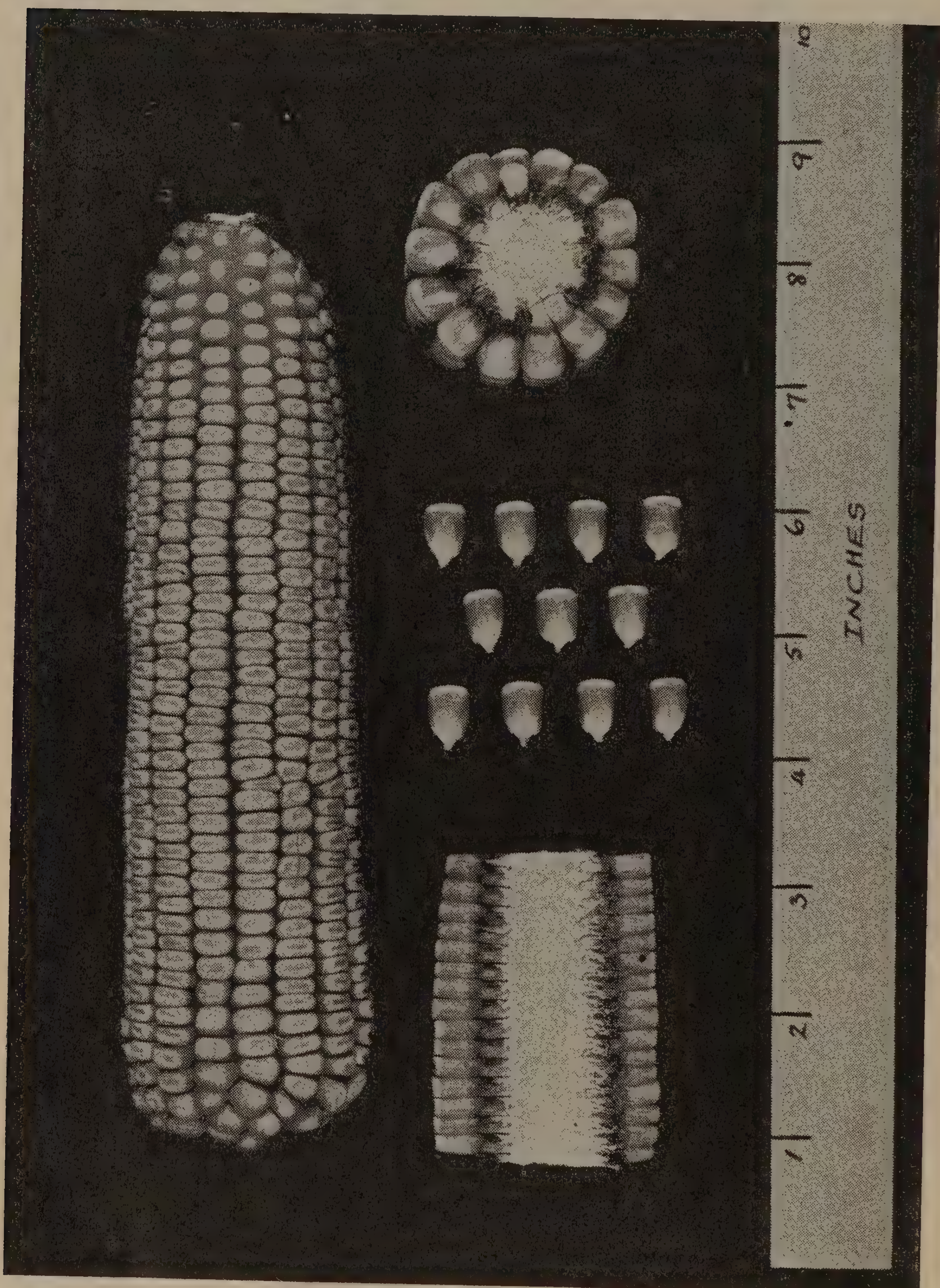


Plate 146.

Hybrid Q739. A mid-early maturing hybrid with uniformly yellow grain.

growing a particular hybrid are clearly set out on the label sealed to every bag of Queensland certified hybrid maize seed. All such Queensland certified hybrids are designated by a number preceded by the letter Q.

Especially should the buyer beware of attempts to sell him hybrids from other sources, as such hybrids have been developed for other districts and may be totally unsuitable for use in the South Burnett. An example of the latter is provided by hybrids from inland northern New South Wales bearing the prefix DS. In tests carried out to date, none of these has shown any promise whatever for the South Burnett district.

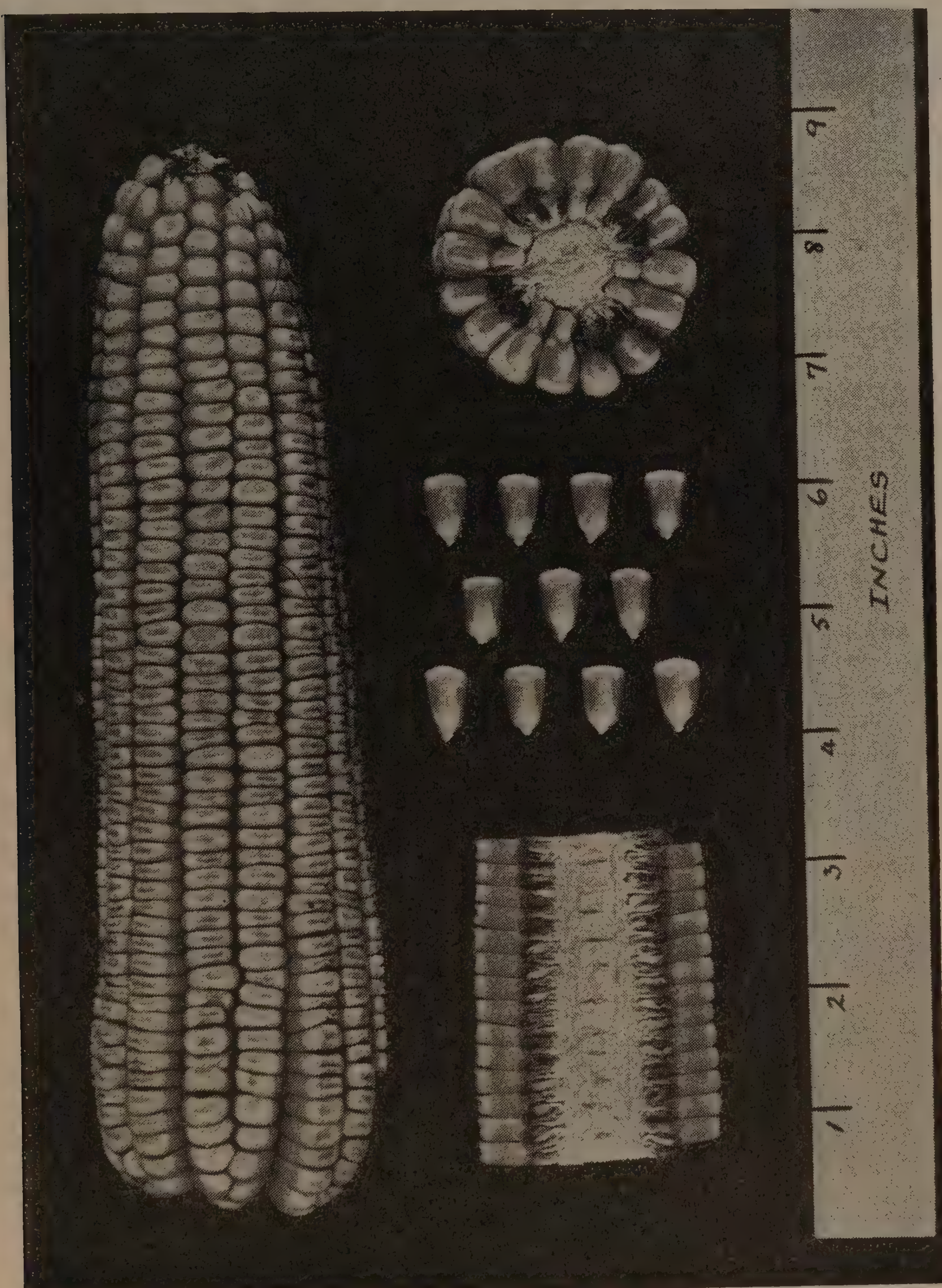
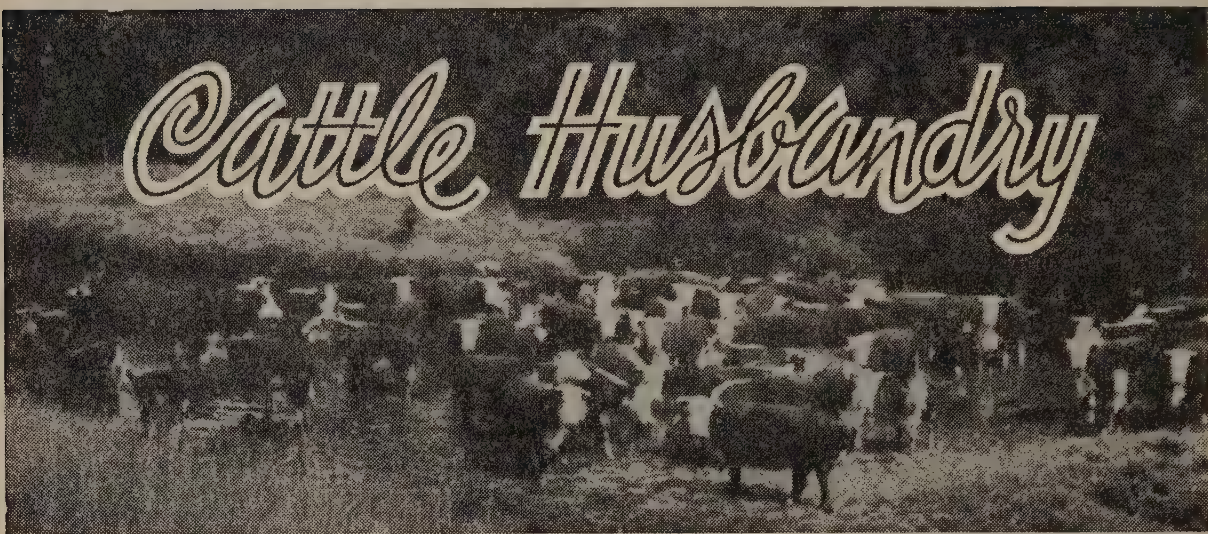


Plate 147.

Hybrid Q431. A late-maturing hybrid with yellow grain.



The Santa Gertrudis Breed of Beef Cattle and Its Possible Use in Queensland.

R. D. CHESTER and K. F. HOWARD, Cattle Husbandry Branch.

FROM time to time new breeds of cattle are evolved in different parts of the world. No single breed of beef cattle can be best suited to all the varying environments within even one continent. Also, as agricultural methods change, so must the type of animal husbandry alter. With the new conditions of husbandry, changes in the characteristics of the cattle may be required. When a breed cannot be altered to fit a new environment it must, in the course of time, give way to a new breed. For this reason, in the past 50 years some 20 new breeds of cattle have been developed in various parts of the world.

Of these new breeds, one is the Santa Gertrudis, a breed evolved on the King Ranch (Texas, U.S.A.) by crossing two species—*Bos taurus,* represented by the British Shorthorn, and *Bos indicus,* represented by the American Brahman. The recent introduction of Santa Gertrudis cattle into Australia has caused considerable interest in the possible use of this breed in the subtropical and tropical environments of Central and North Queensland.

Apart from the introduction of a single bull in 1933, this year is the first time this particular breed has been brought to Australia. Both male and female cattle are included in the later importation, so a pure breeding herd can now be established for the first time.

HISTORY OF KING RANCH BREEDING POLICY.

The King Ranch was established in 1852 with a herd of Longhorn cattle. The ancestors of these cattle were of Spanish origin and in general appearance were leggy, shallow beasts with few of the beef characteristics associated with improved British beef breeds. They were, however, very hardy animals capable of surviving and maintaining a high degree of fertility under adverse conditions.

In an attempt to improve the beef qualities of their herd, the management between 1880 and 1885 introduced both Hereford and Shorthorn cattle. Stud herds of both breeds were established and a

process of grading-up the Longhorn cattle by the use of good-quality Hereford and Shorthorn sires was undertaken. After some years two large herds, about 25,000 breeders in each, of good-quality Herefords and Shorthorns were established. It is of interest for Queenslanders to note that the distribution of the two breeds on King Ranch was of a similar pattern to their distribution in Queensland—Herefords in the better, more reliable country, and Shorthorns in the poorer class country.

The change-over from Spanish-type to British cattle occupied some 40 years, during which time property improvement on the ranch was continuous and cattle tick was eradicated.

When the change-over was complete and good quality herds of British breeds established on a well-improved, tick-free property, the management was not satisfied with the results obtained. The British cattle commanded a better market than the Spanish types but did not thrive well under range conditions and were not so fertile. In addition, they suffered more from insect worry, particularly in time of drought and during the hotter months of the year.

About 1910 the King Ranch obtained a half-bred Shorthorn x Brahman bull. This bull, a large black animal (known as the O'Connor Bull) was mated with some purebred Shorthorn females. Only one bull calf from this bull was kept in the herd, but his daughters were mated back to Shorthorn bulls. The management of the ranch was impressed by the ability to thrive shown by these crossbred animals. They developed as big-boned, fat cattle on natural grass pastures. No stunted cattle developed from this strain, but the steers were not uniform and many showed a goose rump which was considered highly undesirable. This description may be applied equally well to Zebu x British breed crosses in Queensland.

From 1910 to 1918 experiments with part-Brahman cattle were carried out by breeding them with Herefords and Shorthorns. Observations convinced the management that these crossbred cattle were superior to the British breeds except for their lack of uniformity.

In the light of experience, it was decided that three-eighths Brahman and five-eighths Shorthorn was the most desirable combination. This appeared to give maximum size, hardiness and ability to fatten, a higher dressing percentage, resistance to heat and insect pests, and practical elimination of the hump.

In discussing the formation of the Santa Gertrudis, Mr. R. Kleberg, the present principal of King Ranch, states that it was evident from the beginning of the experiment that single-crossing and back-crossing of Shorthorn and Brahman did not accomplish anything of a permanent nature. This fact has already become apparent in Queensland, where haphazard crossing between British breeds and Brahman cattle over a period of twenty years has achieved no worthwhile end, though some of the crossbred animals have been superior in many respects to both of the original parents.

The Klebergs realised that something more than indiscriminate cross-breeding was required, so breeding plans were prepared to establish a new breed better suited to the ranch conditions. At this time a bull, "Vinotero," containing approximately three-quarters Brahman blood

STANDARD OF EXCELLENCE OF SANTA GERTRUDIS BREEDERS' INTERNATIONAL.

tem.	Desirable.	Permissible.	Objectionable.	Disqualification.
A. Colour.				
1. Coat	Solid Santa Gertrudis red	White spotting not to exceed half area on underline; some white hairs in switch. Slight dilution of red	Creamy underline	White or other spotting on other parts of body. Dilution of red to fawn or creams. Brindling in any extent. Roan condition
2. Mucous membranes	Red	..	..	Black
3. Skin	Red pigmented	..	..	Black
4. Horns and Hoofs	Red pigmented	..	..	..
B. Disposition.				
1. Temperament	Mild, tractable	..	Nervous	..
C. Adaptability to Climate (especially Heat).				
1. Hair	Short, straight, slick coat	Medium length	Long hair	Long wavy hair. Dry coat
2. Hide	Loose, thin. Surface area increased by neck folds and sheath	..	Excessive skin folds and sheath	Absence of neck folds
D. Size.				
..	Large for age	Medium size	..	Small for age
E. Conformation.				
Any extreme manifestations of objectionable characters will automatically disqualify the individual.				
1. General form of type	Symmetrical, broad deep body, strong bone, legs straight, free moving	..	..	Extremely rangy. Extremely compact

2. Head	Showing masculinity or feminity according to sex. Broad, slightly convex forehead. Straight profile		Long and narrow. Dished face	
3. Horns		Horned condition. Polled condition		
4. Eyes	Large, prominent, pigmented			
5. Ears	Medium to large size, drooping, fine texture	Horizontal position	Small	
6. Neck	Clean - throated, smooth attachment to shoulder. Loose skin folds			Absence of folds
7. Crest	Evidence of hump immediately forward of the top of the shoulders (in males)	Absence of hump	Large hump	
8. Shoulder	Smooth		Heavy	
9. Brisket	Broad, prominent			
10. Heart girth	Deep, broad			
11. Crops	Full			
12. Back	Broad, level		Low back	
13. Loin	Broad, full		Flat, low	
14. Ribs	Well-sprung, deep		Short rib	
15. Flanks	Deep		Shallow	
16. Hocks	Broad, level		Very prominent	

STANDARD OF EXCELLENCE OF SANTA GERTRUDIS BREEDERS' INTERNATIONAL—*continued.*

Item.	Desirable.	Permissible.	Objectionable.	Disqualification.
17. Rump	Long, moderate slope front to rear. Broad, somewhat rounded on top	Level	Short, pointed	Excessive droop
18. Tail	Smooth insertion, long, switch reaching well below the hocks	..	High insertion, short tail ..	..
19. Thighs	Broad, full	..	..	..
20. Twist	Broad, deep, full	..	..	Narrow, high
21. Legs	Medium length. Squarely set	..	Short legs. Long legs ..	Straight hock
22. Udder and teats ..	Medium size, balanced ..	..	..	Under-developed
23. Sheath	Medium size	..	Excessive size	Absence of sheath
24. ..	..	..	..	Hereditary deformities

came in contact and mated with a cow in a ranch division's milking herd. This cow contained one-sixteenth Brahman blood which originated in the O'Connor bull mentioned earlier; it was a good ranch milk cow of blood-red colour with white undermarkings. The bull resulting from this mating, born in 1920, was known as "Monkey" and proved to be an outstanding animal. "Monkey" was really the foundation animal of the Santa Gertrudis breed.

THE POLICY OF INBREEDING ADOPTED BY KING RANCH.

Immediately the bull "Monkey" was selected by progeny test as the outstanding sire available, the whole breeding policy of the Santa Gertrudis breed was concentrated on using "Monkey" and his offspring to the maximum possible extent. "Monkey" was mated to crossbred Brahman x Shorthorn heifers with proportions varying from three-eighths to seven-sixteenths Brahman blood, and for many years now only "Monkey," his sons, grandsons, daughters and grand-daughters have been used in the stud herd. In all cases careful selections have been made and only the best individuals of red colour have been used.

General improvement in the breed is being maintained by using the best male descendant of "Monkey" in the top stud herd and using the sons of this bull on a herd consisting of some 400 cows.

THE SANTA GERTRUDIS BREEDERS' INTERNATIONAL.

In May, 1952, there were about 65 properties apart from King Ranch breeding Santa Gertrudis cattle. The purebred cattle in the herds had in almost all instances been graded-up by the use of King Ranch bulls on cows of other breeds. The King Ranch does not normally sell heifers. The breeders have formed themselves into a breed society known as the Santa Gertrudis Breeders' International, with headquarters at Kingsville, Texas. The society was formed to protect the interests of the breed. A schedule of breed standards has been drawn up by the society and is reprinted in this article (pages 290-292).

The society recognises a classification system whereby owners may submit cattle with certain breeding qualifications for classification. The breed classifier then classes these cattle as "certified purebreds," "accredited" or "cut outs" according to the breed type of the individual. Of 5,927 cows and heifers submitted for classification from 65 herds to May, 1952, 43·9% were classified as purebred, 37·4% as accredited, and 18·7% as cut outs.

Before cattle are eligible for nomination for classification, there are three conditions that must be satisfied:—

(1) The owner must furnish evidence of the origin of the herd.

(2) The cattle offered for classification must be the offspring of at least four top-crosses of purebred or registered Santa Gertrudis bulls.

(3) The owner must have kept a private herd book for at least one year before acceptance.

Plate 148.

Top-grade $2\frac{1}{2}$-years-old Santa Gertrudis Heifers on King Ranch, Texas.

Plate 149.

Group of Cows and Calves on King Ranch.

DESCRIPTION OF THE SANTA GERTRUDIS BREED.

This is a breed of beef cattle originating from the incorporation of five-eighths British Shorthorn and three-eighths American Brahman. The cattle are whole red in colour, sometimes showing small amounts of white on the underside and occasionally white on the forehead. Skin, horn and hoof pigmentation is red.

The cattle are large, with heavy bone. The hair is short and straight, and the hide is loose and thin, with ample neck folds and sheath. The ears are fairly large in size and drooping. A small hump is evident immediately forward of the wither.

The rump is broad and shows only a moderate slope. The thighs are broad and full and the twist full and deep. The legs are of medium length and set squarely on the body.

Familiarity with the desired type is essential for successful development of the breed. It should be remembered that the conformation differs considerably from that of modern British breeds and selecting for the low-set British breed type may result in the loss of the breed's chief advantages.

Disposition.

Brahman cattle are generally of a highly nervous disposition, which has rendered them and their crosses with British cattle unsuitable for use in poorly improved country. Unfortunately, the nervous temperament of the Brahman seems to be strongly inherited by the crossbreds. This has proved one of the least satisfactory features of Brahman-cross cattle in Queensland. The Santa Gertrudis Breeders' International lists nervous temperament as an objectionable feature when present in its cattle. In Queensland, breeders should go further than this and include nervous temperament amongst those qualities for which cattle are disqualified from classification.

Standard of Excellence.

Section V. of the Constitution of the Santa Gertrudis Breeders' International sets out, as at 1952, the standard of excellence shown on pages 290-292 by which Santa Gertrudis cattle shall be judged.

ADVANTAGES OF THE BREED.

The Santa Gertrudis breed of cattle has been claimed to have a high degree of uniformity while still retaining the advantages of the Brahman x Shorthorn cross. They are said to forage well under adverse conditions, make very good mothers, be little affected by high temperatures, have considerable resistance to insect pests, and grow at a fast rate.

Taking each of these attributes in turn, they may be considered in relation to the Queensland environment as follows—

(1) *Foraging ability.*—This is important in beef cattle in Queensland, where for several months of the year pasture is usually not readily available. An animal with ability to walk long distances and to graze for long periods of the day has definite advantages in such an environment. If Santa Gertrudis cattle prove to have better foraging ability than British cattle, this will be a useful attribute. There is

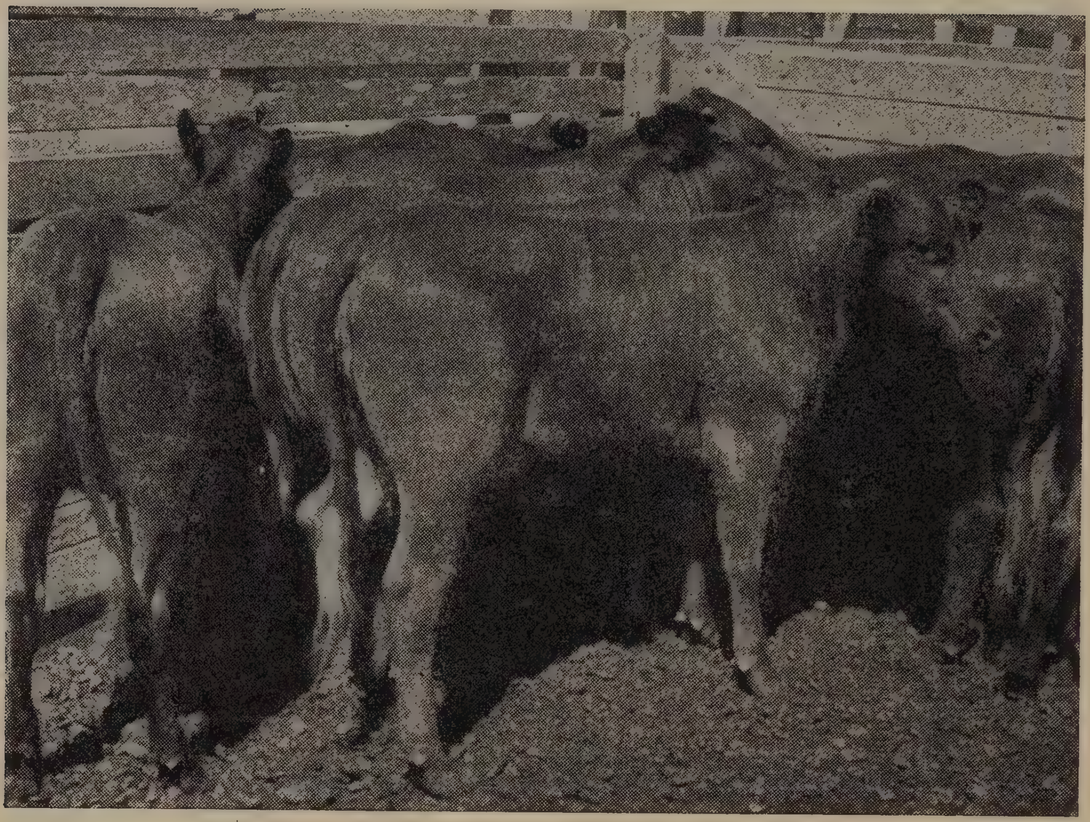


Plate 150.

Eight-months-old Heifers now in Australia Photographed before their Departure from Texas.

Plate 151.

A Mature Santa Gertrudis Bull in Working Condition.

little doubt that Zebu-crossbred cattle now existing in Queensland are better foragers than purebred British cattle under the adverse conditions existing in late winter and spring.

(2) *Mothering ability.*—It is difficult to say whether low branding percentages are due mainly to infertility or to calf mortality after birth, but if Santa Gertrudis females prove better mothers than females of other breeds, then branding percentages could be improved considerably.

There is evidence that Brahman-crossbred cattle are better mothers than purebred British cattle in certain areas of Queensland, but from time to time their fertility has been questioned. The mating of a higher percentage of Brahman-crossbred bulls than when British bulls are used seems to be an accepted procedure in Central Queensland, but otherwise there is little to indicate a difference in fertility between British and Brahman-crossbred cattle.

(3) *Reaction to high temperatures.*—There is little doubt that some strains of British cattle are affected by the high temperatures of North Queensland, particularly on the coast. Cattle which are not affected by high temperatures will graze for longer periods during the day and will not suffer the depression in appetite suffered by some strains of British cattle. This will be reflected in their ability to fatten at an early age during the hot period of the year. Calves and growing cattle are most adversely affected by heat. Inability of the heat-regulating mechanism of young animals to accommodate itself to high temperatures is undoubtedly one of the reasons why it is more difficult to fatten cattle at an early age in North Queensland than in southern Queensland. The loose hide and short, smooth hair of the Santa Gertrudis are responsible for its heat-tolerance, so retention of these characteristics is of paramount importance.

(4) *Resistance to insect pests.*—The most important external parasite of cattle in Queensland is the cattle tick (*Boophilus microplus*). This was eliminated from Texas prior to the evolution of the Santa Gertrudis breed. Undoubtedly the pure Brahman and its first-cross has superior resistance to the cattle tick than British breeds of cattle, but the resistance retained by the Santa Gertrudis is not known for certain. The breed retains the short hair of the Brahman as well as its ability to move the skin freely. This ability may be of advantage in buffalo fly areas. Tolerance to sandfly could be an important factor in the Dawson and Mackenzie River country.

(5) *Rate of growth.*—The aim of better husbandry techniques in the beef cattle industry is to turn off a greater weight of beef per acre. This can be achieved by marketing cattle of a given weight at a younger age and so increasing the turn-over in the herd. If steers can be sold a year earlier without reducing carrying capacity, then the breeding herd can be increased proportionately. A breed which can produce steers ready for slaughter at three rather than four years of age has obvious advantages.

The real test of usefulness of the Santa Gertrudis breed in Queensland will be its ability to grow and fatten at a faster rate than the cattle now available to the pastoralist. Only time and carefully controlled observations can produce satisfactory evidence on this point. Until evidence one way or the other is available, the progressive

Plate 152.
Mature Santa Gertrudis Cows.

Plate 153.
An 18-months-old Bull, One of the First Shipment, illustrating Sleek Hair and Loose Skin Characteristic of the Breed.

grazier will retain an open mind on the subject. British breeds and the stud industry associated with them have played a very valuable part in the development of Queensland's pastoral industry. It would be unwise to throw away the great wealth of beef quality built up over a period of a century and gamble on easy gains from the introduction of a breed possibly inferior in beef qualities. On the other hand, the industry cannot afford to neglect experimenting with new material and to incorporate any worthwhile features that come to light.

POSSIBLE USES OF SANTA GERTRUDIS IN QUEENSLAND.

There is a considerable amount of practical evidence, much of it of a circumstantial nature, to show that cattlemen in Central and North Queensland have for long been dissatisfied with the results obtained from the breeds of cattle so far available to them. The frequent attempts to improve herd cattle by breed changes, by crossbreeding or by the infusion of a small percentage of a different breed into established herds, and the increasing popularity of all types of Brahman-crossbreds, are indications of this. It might be argued that the districts in which this state of affairs exists are naturally difficult areas where soil is frequently of low fertility and rainfall unreliable, and that in an attempt to find a solution to the problem cattlemen have aimed at breeding cattle suited to the poor environment rather than improving the environment to suit better-quality cattle. The correct course probably lies somewhere between the two extremes. Increased prosperity in the industry and a more progressive land utilisation policy could mean considerable advances in property improvement and husbandry methods adopted. Greater attention on the part of the stud industry to developing strains of cattle within the breeds more suited to the environment could improve the status of British cattle in these areas. On the other hand, Brahman cattle have shown their ability to thrive better under adverse conditions than pure British cattle but have some real disadvantages which should not be overlooked in assessing their value to the industry.

It should not be expected that the Santa Gertrudis will be suited to all areas in Queensland, but considering the success of the breed in Texas it does appear likely that it could be successful in districts further south than those where Brahman-cross cattle are now popular. The great need for a breed with the attributes of the Santa Gertrudis is, however, in the areas north of the tropic, particularly in coastal and sub-coastal districts.

The King Ranch lies on about the latitude of Nambour and Roma in Queensland; it is not in a tropical area. Although the property runs onto the coast of the Gulf of Mexico it has a dry rather than humid climate, with an average relative humidity of about 40%. It does not experience extremes of temperature: average summer temperatures are in the 80°F.-90°F. bracket and average winter temperatures are 50°F.-60°F.

Average rainfall is in the vicinity of 25 inches a year and is fairly evenly distributed.

There are thus important differences between the climate of King Ranch and that of much of Queensland and it therefore cannot be assumed that because the breed does well at King Ranch it will do equally well in Queensland.

Plate 154.

A Leading American Geneticist Classifying a Herd of Santa Gertrudis in the West of Southern Texas. Cows are grouped as "certified," "accredited," or "culls" on properties outside King Ranch.

Plate 155.

Partly Eaten Prickly Pear and Mesquite Trees in Southern Texas. This type of vegetation is typical of many parts of the area. The country varies from open plains to thick scrub.

Also, in Texas in most cases the use of this breed was preceded by the establishment of Zebu or part-Zebu herds. The fact is mentioned because it must be realised that part-Zebu cattle require careful handling and that American ranches handling these cattle are equipped with sound fences and yards as well as that important factor—experienced men.

BREEDING PLANS FOR SANTA GERTRUDIS IN QUEENSLAND.

It must be clearly understood by cattlemen that the Santa Gertrudis breed is not just another type of Zebu or Brahman cattle. It is, in fact, a true-breeding composite of Brahman and Shorthorn which has been developed as an ideal beef producer under conditions prevailing in Texas. By correct use of the Santa Gertrudis, Queensland breeders may be saved 20 or 30 years of developmental work which would be necessary if Brahman x British crosses were used. This, of course, will only be so if the Santa Gertrudis thrives in the Queensland environment. There is, however, a right way and a wrong way to use such a breed if quick results and good economic returns are to be obtained. The right way is to base its use on a sound, planned breeding programme with a definite result as its objective.

There are two directions in which Queensland cattlemen can make use of the limited supply of Santa Gertrudis bulls likely to be available. Firstly, these bulls may be used for crossing with existing breeding herds for the production of first-cross slaughter animals; and secondly, the bulls may be used to grade-up existing herds from their present breed status to what amounts to purebred Santa Gertrudis.

PRODUCTION OF FIRST-CROSS SANTA GERTRUDIS SLAUGHTER STOCK.

The cattleman who is dissatisfied with the present production of his herd but who is not prepared at this stage to set out to produce a grade Santa Gertrudis herd may be well advised to try this method of using this breed. Little permanent loss is likely to result from a trial of such a breeding programme. The existing breeding herd will not be affected and the offspring of the cross, even if not so successful as anticipated, will still be of some considerable value as slaughter animals.

If the policy proves successful, the breeder is then confronted with the problem of replacing his breeding herd. He must therefore either maintain two herds or have a source from which he can obtain regular supplies of good-quality breeders to make good the losses in his own herd.

In actual fact, for some time at least, few Santa Gertrudis bulls will be available, so it may be difficult for a breeder to obtain more than one or two bulls: only a limited number of cows could therefore be used for the production of crossbreds and in many herds sufficient of the breeding herd would remain for the production of purebred replacements to mate with the Santa Gertrudis bulls.

It is highly desirable that an even line of cows of good quality be used. If the cows used are of inferior quality or show considerable variation in type, the offspring produced are likely to be disappointing; but if of uniform type, then a good even line of cattle will be produced for sale as stores or fats. First-crosses between breeds usually produce uniform types of offspring. Also, the increased ability to thrive and grow resulting from crosses between breeds, commonly known as hybrid

Plate 156.
A Group of Hand-fed Heifers on King Ranch.

vigour, will be apparent in the calves. They might therefore be expected to grow and thrive better than either of the original parents. This effect is well known to cattlemen in crosses between pure British breeds such as Aberdeen Angus and Hereford and in the famous Blue Roan of the White Shorthorn x Aberdeen Angus cross.

The Santa Gertrudis red colour is firmly established and crossbreeds will show a preponderance of this colour, so reasonable uniformity of colour in the first-cross cattle may be expected.

When crossed with Hereford females, a white face or broken-white face can be expected. This may be an advantage in many Queensland saleyards. With Brahman-cross cows, variations in colour, particularly brindles, will occur, but these will not be so frequent as in the case of Brahman x Hereford crosses. The black points of the Brahman will also appear frequently in these crosses.

The great danger in this type of breeding programme is in retaining the attractive female offspring from the first-cross as replacements in the breeding herd. Crosses between animals which are themselves crossbreds are rarely as uniform or as good as first-crosses, and breeders should not be tempted to retain these females as future breeders unless they are prepared to embark on a grading-up programme and establish properly controlled breeding herds where the breeding history of each group of cows is carefully recorded. Just as few cattlemen would consider using the heifers of the first Hereford x Aberdeen Angus cross as their future breeding herd, so should the heifers of the first-cross Santa Gertrudis be regarded. Their proper place under this scheme of breeding is as maiden speyed heifers in the abattoir.

USE OF THE BREED TO GRADE-UP EXISTING CATTLE HERDS.

It has been pointed out by a world authority on adaptation of cattle to tropical environments that *"the recognised great advantage of the Santa Gertrudis is that with it the cattle raiser in the warmer climates now has available to him a breed that he can use in a grading-up programme."*

Their use as grading-up animals is by far the most satisfactory method of working the few bulls to be available in Queensland. It is the method most likely to bring large economic returns to the individual breeder and greatest progress to the cattle industry generally.

Robert J. Kleberg Jnr., the founder of the breed, in his publication on Santa Gertrudis beef cattle suggests a breeding plan for those using the breed. This plan briefly consists of establishing three separate breeding herds with Santa Gertrudis bulls in each herd. The female offspring in each herd are rotated to the next herd, the bulls remaining permanently in the same herd until the end of their useful life. Mr. Kleberg suggests that in this way the breeder is setting up a convenient line-breeding programme, and at the end of the first complete rotation (that is, three crosses) all progeny will be high-grade Santa Gertrudis animals.

This type of breeding programme might be the best way in which the available bulls could be used in Queensland, and all cattlemen who decide to purchase Santa Gertrudis bulls should make some effort to establish a grading-up programme along these lines.

The principle of grading-up crossbred cattle to a pure breed or of changing from one breed to another by regular use of purebred bulls is well known to breeders of dairy cattle, though perhaps less well known with beef cattle. Each top-cross with a purebred bull of any breed halves the percentage of the original breed in the crossbred. Thus a cross between purebred Santa Gertrudis and purebred Shorthorn produces a half-bred Santa Gertrudis calf. This beast mated to a second purebred Santa Gertrudis bull gives a three-quarters bred calf; the next generation will give a calf seven-eighths Santa Gertrudis and one-eighth Shorthorn; and the fourth cross will be fifteen-sixteenths Santa Gertrudis and only one-sixteenth Shorthorn. At this stage the animal in most cases will be indistinguishable from a purebred and in fact can then be classed as a high-grade Santa Gertrudis.

The variability likely to occur in the crossbred animals, particularly in the second and third generations, renders it most important that the breeder have a clear idea of the type of animal he is trying to produce. In this case, naturally, the animal will be one most closely approaching the standard of excellence set down by the Santa Gertrudis Breeders' International, particularly in colour, conformation, coat and skin type, tolerance to heat, resistance to external parasites and rapid growth rate. Culling to this standard of excellence should then be rigid if rapid progress is to be made in the establishment of a true-breeding herd. Breeders who are not prepared to cull all off-type heifers rigorously for immediate slaughter should at least eliminate them from the top breeding group which are to be mated with the best bull. These heifers could perhaps be used in the commercial herds.

As only small numbers of bulls are likely to be available for some years, single-bull matings are strongly recommended. Breeders fortunate enough to have sufficient bulls should adopt the three-herd system mentioned earlier. Any outstanding sire may be selected whilst he is still alive and used extensively on a selected group of heifers of the best type.

It is strongly urged that breeders neither sell first- or second-cross male offspring as bulls nor use these animals as sires in their own herds. No matter how good an animal may look, its breeding qualities are quite unknown when it is of the first- or second-cross generation. Few breeders would retain a first- or second-cross Hereford x Shorthorn bull for breeding purposes. The dangers of using a first- or second-cross Santa Gertrudis with British breeds would be relatively greater than would be the case with the Hereford x Shorthorn. After the third cross, selected bulls of good conformation may be worthy of a trial in commercial herds. However, these bulls only have seven-eighths Santa Gertrudis blood and should not be thought of as Santa Gertrudis but as crossbred animals.

Prospective users of Santa Gertrudis bulls should give very serious thought to the breed of cattle with which the bulls will be mated. This is particularly the case if the breeder intends to attempt a really constructive grading-up programme.

There is, of course, no evidence in Queensland of the suitability of various breeds as foundation animals, but an enquiry addressed to the Secretary of the Santa Gertrudis Breeders' International and classifier for the breed was answered as follows:

> Observations on many ranches as well as on King Ranch indicate that preferred foundation stock would be in about the following order: part Brahman-Shorthorn, part Brahman-Hereford, straight Shorthorn, straight Hereford, and finally straight Angus.

It cannot be too strongly stressed that the final success of any grading-up programme may well depend on the quality of the cow herd originally selected for mating with the available Santa Gertrudis bulls. Only selected cows of whatever breed is chosen should be used. These cows should be the best available in the breeding herd and of uniform type and conformation. In cases where Brahman-cross cows are to be used as the foundation herd, the difficulty in selecting sufficient cows of uniform type and conformation may be very real. For this reason, extraneous points of smaller commercial value should not be included in the selection score to lessen the weight which can be given to conformation. In this respect, colour is probably a character that many breeders may be inclined to give special attention in the original herd. The red colour is well established in the Santa Gertrudis breed, and it may be expected that even if the original cow herd contains off-colour animals, one or two top-crosses with Santa Gertrudis will rectify this. However, with white-faced cattle three or four top-crosses may be necessary to eliminate the white colour. Therefore, when red cows of the desired conformation are available they should, of course, be used, but when a choice is to be made between red colour and more desirable conformation, the breeder should select for conformation.

For obvious reasons some breeders would prefer to develop a polled herd of Santa Gertrudis, and there appears to be no good reason why this could not be done provided selection is not over-done and cows of good conformation rejected merely because they have horns. Dehorning of calves at branding is not a difficult task, and in developing a new breed the fewer the characters taken into consideration, the greater can be the degree of selection. Those developing the polled breed must also bear in mind that the established breed is horned and polled bulls of desirable conformation are likely to be much more difficult to obtain than horned bulls of equal quality. Constant use of horned bulls in a herd which was originally polled will lead to a very heavy culling percentage merely to retain polled characteristics after two or three generations. These facts should be considered very seriously by breeders before they attempt the grading-up of a polled herd. It is probable that the average breeder would be better advised to use surgery rather than breeding techniques to remove horns, at least until a reliable supply of good-quality polled bulls is available.

Recent Adjustments to Taxation Concessions.

(This statement dealing with taxation concessions to primary producers has been prepared by the Commonwealth Department of Commerce and Agriculture. Its object is to acquaint primary producers with recent adjustments.)

IN order to stimulate agricultural production, the Commonwealth Government decided to assist primary producers by way of taxation concessions in the purchase of necessary farm machinery and in the construction of necessary farm buildings and other structural improvements.

Depreciation on Plant and Buildings.

The recent legislation contains a provision for allowing depreciation at the special concessional rate of 20 per cent. per annum in respect of certain plant installed and structural improvements completed on agricultural and pastoral properties between July 1, 1951, and June 30, 1955. The concession will extend also to structural improvements completed up to June 30, 1956, if they are commenced by June 30, 1955.

The 20 per cent. deduction will be allowed in the year when the plant is installed or the improvement is completed and in each of the following four years.

With the exception of motor cars, station waggons and estate cars, and owners' residences, the concession will apply to all plant on which depreciation is now allowable, provided that the particular item of plant is wholly and exclusively used for agricultural or pastoral purposes.

Besides machines which are designed specifically for these purposes, the 20 per cent. rate will be allowed on such plant as motor lorries, tractors, electric motors, bulldozers and so on, if used for farm or station work only. The concession extends also to structural improvements such as fences, shearing sheds, dairy buildings, fodder conservation buildings, and housing provided for employees, tenants or share-farmers.

At present, the cost of dams, earth tanks, bores, wells, irrigation channels and other structural improvements for the conservation and conveyance of water is allowable in full, in the years in which it is incurred. Plant used in conserving and conveying of water, such as pumps, windmills, water piping, sprinkler systems, overhead tanks and troughing, will be subject to the 20 per cent. concessional rate of depreciation. This allowance will permit the cost of this plant also to be written off over a period of five years.

For the first year of operation, it is estimated that the total value of the concession to primary producers will be in the vicinity of £6 millions. In later years, when the special depreciation is allowed on plant purchased over a longer period, the value of the concession will be progressively greater.

Insurance Recoveries.

Previously, the law required that insurance recoveries received by primary producers on the loss of livestock be included in the income tax assessment for the year when it was received. As a result, the primary producer frequently found that, after being taxed on the insurance moneys, he had insufficient funds left to finance the necessary replacement of his destroyed stock.

The problem of alleviating these financial difficulties became urgent when the full extent of the disastrous fires which ravaged large areas of eastern Australia early this year was known.

The Government inquired into the problem and decided to adopt a plan whereby the primary producer, if he so desired, could spread his liability to tax on the recovery over five years instead of being taxed wholly in one year.

The recent legislation, accordingly, included a provision to grant primary producers a right of election whereby only one-fifth of insurance moneys received since June 30, 1951, would be included in the year of receipt and in each of the next four succeeding years.

This provision will apply not only where the loss is caused by bush fires, but also where it is due to flood, drought, stock disease or any other disaster.

CHANGE OF ADDRESS.

Journal subscribers notifying change of address should state their full Christian names and surname as well as their full former and new addresses.

Address all communications to the Under Secretary, Department of Agriculture and Stock, Brisbane.

Brucellosis Testing of Swine.

The Department of Agriculture and Stock is operating a scheme whereby pig herds are tested at intervals for the occurrence of swine brucellosis (contagious abortion).

A herd listed by the Department as ''brucellosis tested'' is one in which all such animals as may be determined by the Director of the Department's Division of Animal Industry have been subjected to two successive tests for brucellosis, at intervals determined by him, without any positive reactors being found.

In order for a herd to be retained on the list of Tested Herds, a semi-annual or annual re-test of the herd, as determined by the Director, is required. If at a re-test any animal gives a positive reaction to the test the herd is removed from the list; it is not listed again until subsequent tests, as determined by the Director, have been carried out.

Full particulars of the Brucellosis Testing of Swine and application forms may be obtained from the Under Secretary, Department of Agriculture and Stock, William Street, Brisbane.

TESTED HERDS.

(AS AT 13th OCTOBER, 1952.)

Breed.	Owner's Name and Address of Stud.
Berkshire	J. J. Bailey, " Lucydale " Stud, East Greenmount
	S. Cochrane, " Stanroy " Stud, Felton
	Garrawin Stud Farm Pty. Ltd., 657 Sandgate road, Clayfield
	G. Handley, " Handleigh " Stud, Murphy's Creek
	J. L. Handley, " Meadow Vale " Stud, Lockyer
	R. G. Koplick, " Melan Terez " Stud, Rochedale
	O'Brien and Hickey, " Kildurham " Stud, Jandowae East
	E. Pukallus, " Plainby " Stud, Crow's Nest
	G. C. Traves, " Wynwood " Stud, Oakey
	E. Tumbridge, " Bidwell " Stud, Oakey
	Westbrook Farm Home for Boys, Westbrook
	H. W. Wyatte, Rocky Creek, Yarraman
	H.M. State Farm, " Palen Creek," Palen Creek
	A. R. Ludwig and Sons, " Cryna " Stud, Beaudesert
	H. H. Sellars, " Tabooba " Stud, Beaudesert
	F. Thomas, M.S. 373, Beaudesert
	D. T. Law, Trouts Road, Aspley
	C. F. W. and B. A. Schellback, " Redvilla " Stud, Kingaroy
	R. H. Crawley, "Rockthorpe" Stud, via Pittsworth
	F. R. J. Cook, "Alstonvilla," Woolvi, via Gympie
	D. E. and E. C. Apelt, "Thelmur," Oakey
	Mrs. I. M. James, "Kenmore" Stud, Cambooya
	H. L. Stark, "Florida," Kalbar
	J. H. N. Stoodley, "Stoodville," Ormiston
	H.M. State Farm, Numinbah
Large White	H. J. Franke and Sons, " Delvue " Stud, Cawdor
	Garrawin Stud Farm Pty. Ltd., 657 Sandgate road, Clayfield
	F. L. Hayward, " Curyo," Jandowae
	J. A. Heading, " Highfields," Murgon
	K. B. Jones, " Cefn " Stud, Pilton
	R. G. Koplick, " Melan Terez " Stud, Rochedale
	R. Postle, " Yarralla " Stud, Pittsworth
	E. J. Bell, " Dorne " Stud, Chinchilla
	L. C. Lobegeiger, " Bremer Valley " Stud, Moorang, via Rosewood
	J. H. G. Blakeney, " Talgai " Stud, Clifton
	H. R. Gibson, "Thistleton" Stud, Maleny
	H.M. State Farm, Numinbah
	K. A. Hancock, "Laurestonvale" Stud, Murgon
	O. H. Horton, Mannuem, Kingaroy

TESTED HERDS—continued.

Breed.	Owners Name and Address of Stud.
Large White—*continued*	V. P. McGoldrick, " Fairymeadow " Stud, Cooroy
	N. Woltmann and Sons, Wooroolin
	R. S. Powell, Kybong, via Gympie
	E. B. Horne, "Kalringal," Wooroolin
	S. T. Fowler, "Kenstan" Stud, Pittsworth
	J. A. and J. McNicol, "Camden," Canning Vale, Warwick
	H. L. Larsen, "Oakway," Kingaroy
Tamworth	S. Kanowski, " Miecho " Stud, Pinelands
	N. R. Potter, " Actonvale " Stud, Wellcamp
	D. F. L. Skerman, " Waverley " Stud, Kaimkillenbun
	A. C. Fletcher, " Myola " Stud, Jimbour
	Salvation Army Home for Boys, Riverview
	F. Thomas, M.S. 373, Beaudesert
	A. J. Surman, Noble Road, Goodna
	P. V. McKewin, "Wattleglen" Stud, Goombungee
	Department of Agriculture and Stock, Regional Experiment Station, Kairi
	P. V. Campbell, Lawn Hill, Lamington
	E. C. Phillips, "Sunny View," M.S. 90, Kingaroy
	T. A. Stephen, "Withcott," Helidon
	W. F. Kajewski, "Glenroy" Stud, Glencoe
	A. A. Herbst, Bahr Scrub, via Beenleigh
	R. G. Koplick, "Melan Terez" Stud, Rochedale
	H.M. State Farm, Numinbah
Wessex Saddleback ..	W. S. Douglas, " Greylight " Stud, Goombungee
	D. Kay and P. Hunting, " Kazan " Stud, Goodna
	E. Sirrett, " Iona Vale " Stud, Kuraby
	C. R. Smith, " Belton Park " Stud, Nara
	H. H. Sellars, " Tabooba " Stud, Beaudesert
	H. Thomas, " Eurara " Stud, Beaudesert
	D. T. Law, Trouts Road, Aspley
	G. J. Wilson, " Glenbella " Stud, Silverleigh
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ASTRONOMICAL DATA FOR QUEENSLAND.

DECEMBER.

Supplied by W. J. Newell, Hon. Secretary of The Astronomical Society of Queensland.

TIMES OF SUNRISE AND SUNSET.

At Brisbane.			MINUTES LATER THAN BRISBANE AT OTHER PLACES.					
Day.	Rise.	Set.	Place.	Rise.	Set.	Place.	Rise.	Set.
	a.m.	p.m.						
1	4.45	6.28	Cairns	51	7	Longreach ..	44	26
6	4.46	6.32	Charleville	30	24	Quilpie	33	37
11	4.47	6.35	Cloncurry	65	35	Rockhampton ..	19	1
16	4.49	6.38	Cunnamulla ..	27	32	Roma	19	15
21	4.51	6.41	Dirranbandi ..	16	22	Townsville ..	42	8
26	4.54	6.43	Emerald	28	11	Winton	52	29
31	4.56	6.46	Hughenden ..	49	21	Warwick	2	6

TIMES OF MOONRISE AND MOONSET.

At Brisbane.

Day.	Rise.	Set.
	p.m.	a.m.
1	6.24	3.56
2	7.23	4.46
3	8.17	5.41
4	9.04	6.38
5	9.45	7.36
6	10.21	8.33
7	10.53	9.28
8	11.22	10.21
9	11.50	11.14
		p.m.
10	..	12.05
	a.m.	
11	12.18	12.58
12	12.47	1.53
13	1.19	2.50
14	1.55	3.51
15	2.37	4.55
16	3.26	5.59
17	4.24	7.01
18	5.28	7.58
19	6.36	8.49
20	7.46	9.33
21	8.54	10.12
22	9.59	10.47
23	11.03	11.21
	p.m.	
24	12.05	11.55
25	1.07	..
		a.m.
26	2.09	12.30
27	3.12	1.09
28	4.14	1.52
29	5.14	2.39
30	6.09	3.31
31	6.58	4.28

MINUTES LATER THAN BRISBANE (SOUTHERN DISTRICTS).

Charleville 27; Cunnamulla 29; Dirranbandi 19;
Quilpie 35; Roma 17; Warwick 4.

MINUTES LATER THAN BRISBANE (CENTRAL DISTRICTS).

Day.	Emerald.		Longreach.		Rockhampton.		Winton.	
	Rise.	Set.	Rise.	Set.	Rise.	Set.	Rise.	Set.
1	10	29	25	44	0	20	27	52
6	13	27	28	42	3	18	31	50
11	20	17	36	32	11	8	42	37
16	30	9	45	24	20	0	53	26
21	24	15	41	30	16	6	47	35
26	13	23	28	39	3	14	31	44
31	10	30	25	45	0	21	27	53

MINUTES LATER THAN BRISBANE (NORTHERN DISTRICTS).

Day.	Cairns.		Cloncurry.		Hughenden.		Townsville.	
	Rise.	Set.	Rise.	Set.	Rise.	Set.	Rise.	Set.
1	5	52	35	65	19	50	5	44
3	3	55	34	67	18	52	4	45
5	9	50	37	63	21	49	8	42
7	18	43	42	59	27	45	16	36
9	27	33	49	54	33	38	23	29
11	32	24	52	46	36	31	26	21
13	42	13	58	39	43	24	35	13
15	51	5	65	34	49	20	42	6
17	55	3	68	32	51	18	45	4
19	52	9	66	36	50	22	43	9
21	42	19	58	43	43	28	35	17
23	30	31	51	52	35	37	25	27
25	19	37	42	56	27	41	17	32
27	9	47	37	62	21	47	8	39
29	3	53	34	66	18	51	4	44
31	5	55	35	67	19	52	5	45

Phases of the Moon.—Full Moon, December 1st, 10.41 p.m.; Last Quarter, December 9th, 11.22 p.m.; New Moon, December 17th, 12.02 p.m.; First Quarter, December 24th, 5.51 a.m.; Full Moon, December 31st, 3.05 p.m.

On December 22nd at 8 a.m., the sun will reach its greatest angle south of the equator, when it will rise and set about 25 degrees south of true east and true west respectively.

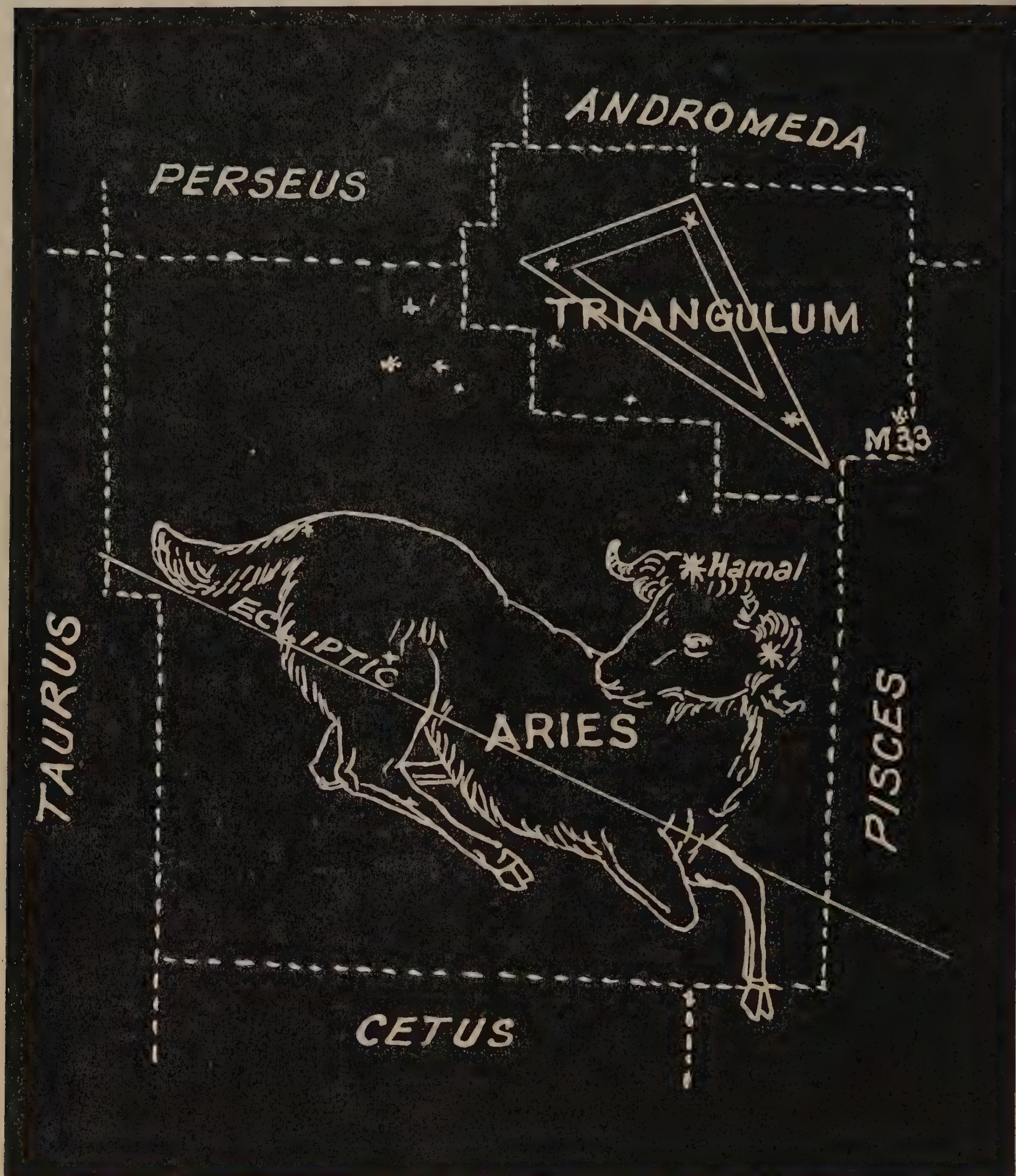
Mercury.—A morning object all this month. In the constellation of Scorpio, on the 1st it will rise with the sun and on the 18th will be at its greatest angle west of the sun. At the end of the month, in the constellation of Ophiuchus, it will rise about 1¼ hours before the sun.

Venus.—In the constellation of Sagittarius, at the beginning of the month will set 3 hours before the sun. The moon will pass Venus on the 20th and at the end of the month the planet, in the constellation of Capricornus, will set 2¾ hours after sunset.

Mars.—At the beginning of the month, in the constellation of Capricornus, will set between 10.30 p.m. and 11.45 p.m., and at the end of the month, in the constellation of Aquarius, will set between 9.45 p.m. and 11 p.m. The moon will pass near Mars on the 21st.

Jupiter.—Will rise during the afternoon hours during this month and set between 3.15 a.m. and 4.30 a.m. on the 1st and between 1.15 a.m. and 2.30 a.m. on the 31st.

Saturn.—In the constellation of Virgo, will rise between 2.15 a.m. and 3.30 a.m. on the 1st and between 12.30 a.m. and 1.45 a.m. on the 31st.



THE CONSTELLATIONS.

ARIES (THE RAM).

This is a zodiacal constellation lying on the ecliptic between Pisces and Taurus. The imaginary point in the heavens where the ecliptic intersects the celestial equator was formerly in this group and was known as the "First Point of Aries." Owing to the phenomenon of the "Precession of the Equinoxes," this point, which marks the spring equinox of the northern hemisphere and the autumn equinox of the southern hemisphere, is no longer in Aries but has moved to Pisces; but for astronomical purposes it is still known as the "First Point of Aries." The constellation is said to represent the ram which carried Phrixus and his sister, Helle, to Colchis to escape the fury of their stepmother, Io. Helle fell into the sea and was drowned, but Phrixus arrived safely in Colchis, where he sacrificed the ram and hung its fleece in the Grove of Aries. This was the Golden Fleece, in search of which Jason and his Argonauts sailed in the ship Argo.

The constellation is easily recognised, Hamal (Alpha), Beta and Delta forming an elongated triangle to the west of the Pleiades, and a line from Hamal through Delta points towards Aldebaran (Alpha Tauri). Hamal crosses the meridian about 8 p.m. towards the middle of December and the group is observable in the northern sky for a month or so on each side of that date.

TRIANGULUM.

As the name implies, the three brightest stars form a triangle, but a very elongated one, which is situated to the north of Aries. Another triangle, "Triangulum Australis," is situated in the southern hemisphere and is placed on the side of the "Pointers" opposite the Southern Cross. M33, a very large spiral nebula, is situated in Triangulum. Iota is a very fine double, one component being yellow and the other blue; their magnitudes are 5.0 and 6.4.

VOL. 75. PART 6 DECEMBER, 1952

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DEPARTMENT OF AGRICULTURE

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MINISTER FOR AGRICULTURE AND STOCK

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11

Contents

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Agriculture in the Mary Valley and Adjoining Districts.

A. HEGARTY, Adviser in Agriculture, Agriculture Branch.

THE development of a district by agriculture is ordinarily slower than by mining; hence the startling gold discovery by Nash in 1867 played the dominant role in rapidly populating the Gympie district in the early days of its history. Agriculture, however, was destined to be the major factor in stabilising the district and in building up a prosperous community. Not only did the Gympie district possess great mineral wealth, but fortunately the climate and country proved very suitable for the development of agricultural industries.

At the time of Nash's discovery, the Gympie district was looked upon as second-class pastoral land and was extensively stocked with Merino sheep. Later it was found that the country was better adapted for raising and fattening cattle.

The agricultural development of the early days was confined to the felling of the rich river scrubs and forest flats, and planting crops to provide food for the mining population and farm produce for the mine horses. Dairying became established in a small way about 1882 with the introduction of the farm separator to the district. During 1906, a small butter factory was opened up to handle the increased dairy production, and from 1915 to 1924 larger premises were established at Gympie, Pomona, Cooroy, Eumundi and Maleny.

With the decline in mining after 1906, the district witnessed a great change-over to agricultural and pastoral pursuits, with large holdings being thrown open for selection. The district is now well established as an important dairying, pastoral, agricultural and fruit-growing district, and all available land is occupied. Very little land of agricultural value is left for selection and unoccupied Crown land has now become the centre of an important reafforestation programme.

The district can claim to be one of the most important dairying areas in Queensland. Sown pastures and agricultural crops are largely responsible for the district's high contribution of 15% of the State's butter production.

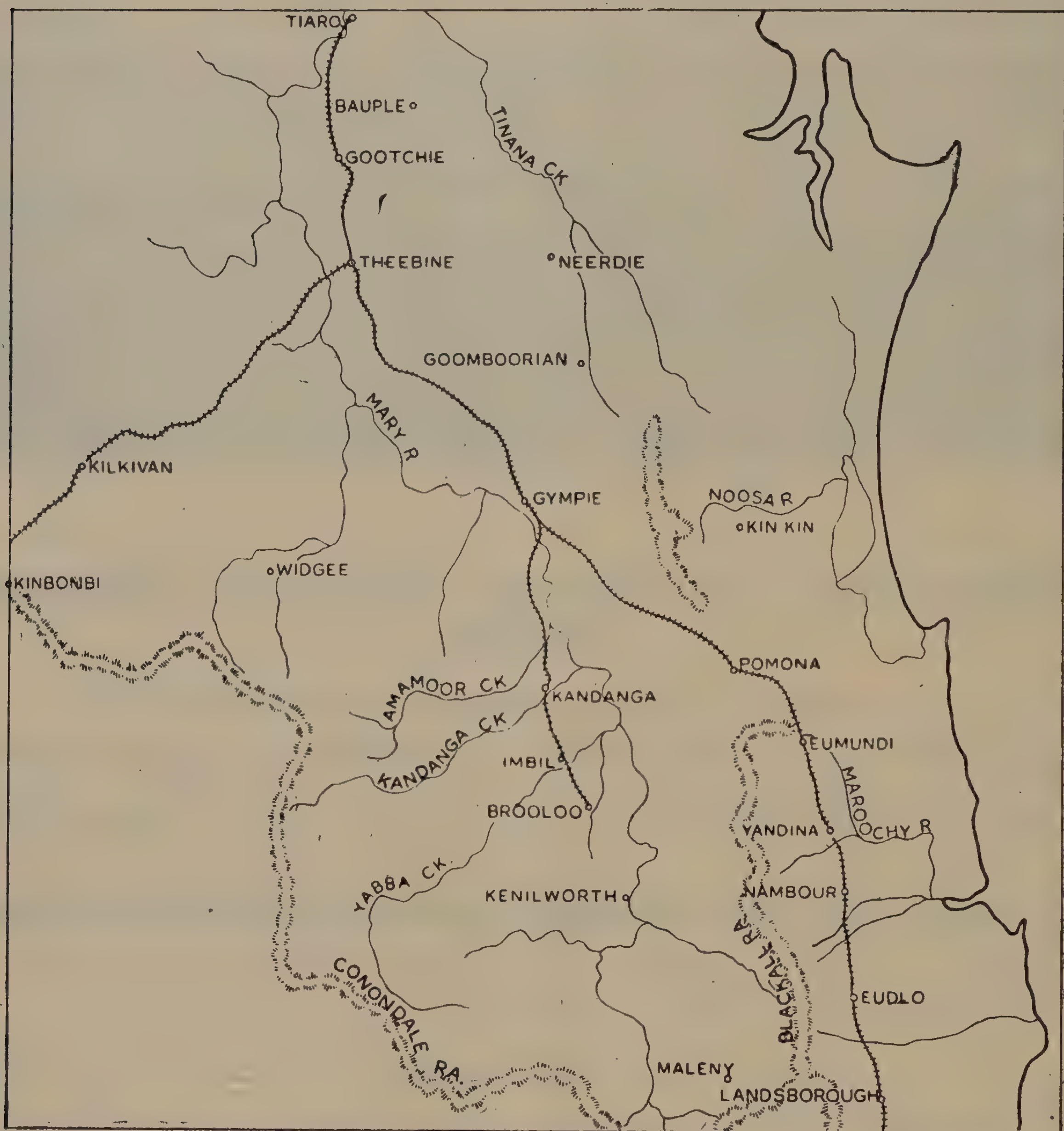


Plate 157.

Sketch Map of the Mary Valley and Adjoining Districts.

The boundaries of the Mary Valley district (Plate 157) may be broadly defined as follows:— On the east, the coastline from Inskip Point to Caloundra; on the south and west, Landsborough, and the Conondale, Jimna and Coast Ranges; on the north, a line through Tiaro from the Coast Range to Inskip Point. The area included is approximately 4,000 square miles, which, with the exception of river flats and a coastal "wallum" strip, is mainly undulating in nature. The Maleny Plateau and Blackall Range constitute a subsidiary watershed ranging in height from 1,210 feet to 1,345 feet.

Gympie (population 8,880) is the main town and is fairly centrally situated to serve the district. Well-established rail and road systems connect all the smaller towns and provide a good network for transport and communication.

WATER FACILITIES.

The district is exceptionally well watered by rivers and creeks. The principal stream is the Mary River, which drains an appreciable basin to the west of the Blackall Range, and travels in a northerly direction, entering the sea near Maryborough. The Mary River drainage system also

embraces a number of useful permanent creeks, the principal of these being Obi Obi, Yabba, Little Yabba, Kandanga, Amamoor, Six Mile, Eel, Glastonbury, Widgee, Wide Bay, and Munna Creeks. All these creeks provide useful stock and irrigation facilities in all seasons.

On the eastern fall of the Blackall Range watershed, the short Mooloolah and Maroochy River systems flow easterly into the Pacific Ocean. Further north the Noosa River system drains a vast area of wallum country and this river flows in a southerly direction, entering the sea at Laguna Bay. Complementary to the Noosa River system the extensive Tinana Creek, embracing Tagigan and Coondoo Creeks, flows northwards to provide the Maryborough water supply at Teddington Weir.

Practically every dairy farm in the district is undulating in nature and each property has a frontage to a permanent creek or gully, which provides excellent stock-watering facilities. Earth dams are not widely used for stock-watering in this district. Of recent years, more use has been made of windmills to supply permanent water from underground but the district cannot claim to have a true sub-artesian system.

Most wells are sunk into local soakage beds and the depth of water-bearing strata may vary from 20 to 80 feet, depending on the type of country.

Irrigation of agricultural crops plays an important role in this district, but practically all water is drawn from permanent rivers and creeks. The fruit and vegetable industries, however, often use dams and wells for a limited water supply, particularly for winter irrigation on frost-free slopes.

CLIMATE.

The Mary Valley district is subject to a wide range of temperature and rainfall. This is due to the variation from the large coastal fringe to the plateau country and thence to the drier western portion. Consequently, agriculture has developed in fairly distinctive zones in relation to rainfall. All sections of the district receive predominantly summer rainfall, with a moderately dry winter and early spring; hence cultivation is designed mainly for summer cropping. However, in years of suitable winter rainfall, winter crops and pastures flourish.

In some years frosts may be early and destructive, but on the average, frosts are moderate and do not cause great damage. Temperature and humidity are usually high in the summer. Drought periods of varying length occur not infrequently in the spring and summer months.

The average monthly rainfall for five recording centres in the district is shown in Table 1. Also included in the table are the mean maximum and mean minimum temperatures for Gympie.

SOILS.

The most important agricultural soils are the alluvials adjacent to the main rivers and creeks. These soils are very fertile and with suitable seasonal conditions produce heavy-yielding crops. They are mostly light-grey loams to dark-grey clay loams of good depth and with good drainage. Most of the agricultural crop production comes from these soils.

TABLE 1.

CLIMATOLOGICAL DATA FOR MARY VALLEY CENTRES.

Recording Centre.	Recording Period in Years.	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Yearly Average.
Rainfall in Points.														
Maleny	27	1,109	1,076	1,028	899	562	421	281	202	269	353	505	809	7,514
Cooroy	50	934	1,027	918	566	446	388	244	180	226	315	397	635	6,276
Gympie	73	657	658	613	343	291	260	207	165	202	273	333	540	4,542
Kilkivan	62	563	491	390	220	185	214	150	135	161	268	266	461	3,504
Tiaro	49	661	541	484	310	230	234	167	122	164	234	275	506	3,928
Mean Maximum Temperature (°F.).														
Gympie	26	88·5	86·9	85·1	82·1	76·9	72·0	71·6	74·1	78·9	83·7	86·7	88·5	..
Mean Minimum Temperature (°F.).														
Gympie	26	66·6	66·5	63·8	57·9	49·9	46·3	42·9	44·2	50·2	56·5	61·3	64·9	..

Plate 158.
Mixed Farming and Dairying Country at Kandanga.

In the drier areas of Woolooga and Kilkivan, agricultural crops are grown on undulating ridge country, where soils of a variety of textures are represented, ranging from light-brown sandy loams to the unusual dark-grey clay loams of the serpentine belt.

Along the coastal fringe there is much hilly country where the soils are usually shallow, mainly overlying schist or shale, and little agriculture is practised on them. Limited cultivation is carried out on the yellow clay loams of the poorly-drained flats.

Plate 159.
Mary River Country.

On the Blackall Range, particularly at Maleny, Montville and Mapleton, a characteristic group of red volcanic loam soils occur. These soils are well drained and are acid in reaction. In the virgin state they carried heavy rain-forest. The Maleny section of this belt of country was sown to pasture and now supports a thriving dairying industry. The Montville-Mapleton section in the past has been devoted to fruit-growing, but a trend to dairying is now occurring.

On the coastal fringe around Nambour-Woombye and at Goomboorian, areas of dark-brown to dark-red-brown loams are used for fruit and vegetable culture. At Bauple the red and brown loams are used for sugar-cane and fruit-growing.

Along the entire coastal strip of the area shown in the map is a stretch of country 10 to 20 miles wide which in the past has been collectively referred to as "the wallum." This area consists of lowlying coastal-plain country. It is made up of a series of low, rolling ridges only a few feet in height separated by extensive areas of lower swampy land. The soils are sandy for depths varying between two and four feet, the texture reaching a sandy loam on some of the better ridges. They are low in plant foods and are usually very acid in reaction. The ridges carry eucalypt vegetation which grades off into a stunted, shrubby vegetation of Banksia and grasstree. On the true swamps, the vegetation is mainly tea-tree and the soils silt loams and clay loams.

At present the low land with a high water-table and poor drainage is practically useless. On the other hand, the ridges which carry a pasture consisting mainly of kangaroo grasses provide useful grazing and are used as drought-relief country (Plate 160).

Plate 160.
Native Kangaroo Grass Pasture in Open Forest.

In view of present knowledge in relation to stock deficiencies and the new field of trace elements, some development of the wallum country may be practicable, as the rainfall over the area is good. Substantial

quantities of fertilizer as well as trace elements will no doubt be required in the first instance. Cattle in this country suffer traditionally from "softbone" and both therapeutic mineral treatment of stock and top-dressing of pastures and crops to correct deficiencies in the soil will be necessary.

A great variability in soils from farm to farm is found throughout the Mary Valley and it is impossible to generalise on soil characteristics. However, some important facts can be enumerated. The soils subject to heavy summer rainfall are all acid in reaction and have pH values ranging from 4·8 to 6·0. This acid condition reflects a deficiency of lime and is usually associated also with a deficiency of available phosphoric acid. Only a small amount of available nitrogen is normally present in the soils. The pastures generally lack a worthwhile legume population, so there is little scope for building up soil nitrogen by the use of pasture legumes. Where lucerne and annual summer or winter legumes can be grown on cultivated land, the problem is not so difficult.

Soil Erosion.

Most cultivation for agricultural field crops is carried out on alluvial flats or light slopes, and soil erosion is not a great hazard. The greatest hazard is present on the fruit and vegetable areas where steep, frost-free slopes are cultivated. Serious soil loss often occurs in these locations.

While most of the hills and ridges are under pasture cover little soil loss occurs, but a serious problem in the coastal hillside pastures is the occurrence of slips. These slips usually appear where clay loams overlie schist or shale; in wet seasons a large volume of saturated soil may slip or skid.

Cultivation is increasing in the Kilkivan area and signs of soil erosion have been observed in several instances there. Early attention to this problem will be beneficial.

In all areas, contour furrowing in pastures is a useful method whereby the volume of run-off water from slopes can be reduced.

VEGETATION AND PASTURES.

Before clearing commenced, a wide range of natural timber vegetation occurred throughout the district, varying from rain-forest on the Blackall Range country to river scrubs, with open-forest country in the drier western portions, and along the coastal strip a bastard type of scrub embracing softwoods and eucalypts.

Grass growth was negligible in the rain-forest and river scrubs, but in the open forest both forest blue grass (*Bothriochloa intermedia*) and Queensland blue grass (*Dichanthium sericeum*) were common. Throughout the higher rainfall belt amongst the bastard scrubs, kangaroo grasses (mainly *Themeda australis*) predominated. As in many other areas in Queensland, the blue grasses, kangaroo grasses and other valuable grasses were quickly eaten out and rapidly replaced by inferior species such as blady grass (*Imperata cylindrica* var. *major*), bracken fern (*Pteridium aquilinum*), bunch spear grass (*Heteropogon contortus*), pitted blue grass (*Bothriochloa decipiens*), and wire grasses (species of *Aristida*). Improvement of these native pastures presents a problem. Valuable areas of Rhodes grass have been established, and in recent years small areas of green panic (*Panicum maximum* var. *trichoglume*) have shown promise.

Plate 161.

Paspalum Pasture and Windbreak, Maleny.

Plate 162.

A Dairy Farm at Maleny.

However, useful grass species were available for sowing on cleared land, and in the Mary Valley district there now are extensive areas of introduced grasses. With the large-scale clearing of land which occurred between 1906 and 1924, thousands of acres were sown to paspalum (Plate 161) and Rhodes grass. In recent years, particularly on the Blackall Range country, extensive areas have been planted with kikuyu grass (Plate 162). These introduced grasses are responsible for maintaining the large dairying industry. A notable feature of the pastures is the lack of a good pasture legume. In recent years the invasion of mat grass (*Axonopus affinis*) into paspalum pastures has created a serious problem, particularly on the wet coastal strip.

Plate 163.

Coastal Pastures on Hillsides, Cooroy.

Much of the country is so hilly and steep that it does not lend itself to safe cultivation. Pasture-farming therefore plays a most important part in the prosperity of the primary industries of this district.

Pasture Renovation.

A number of problems have arisen on the extensive acreage sown to exotic grass species. Much of this area was sown to paspalum, and declining productivity of the grass is now a major problem. Paspalum pastures become sodbound after a number of years' grazing, and mechanical means of renovation are required to correct this condition. On shallow soils the use of cutaway disc harrows and the stiff-tine renovator (Plate 164) has given very good results, and provided the treatment is thoroughly carried out, excellent regrowth will occur following rain. On deeper soils the rotary hoe and the mouldboard plough have been used successfully. Although paddocks treated in this way require a considerable spell before grazing, it is considered that the improvement in pastures which is obtained makes drastic treatment of this type well worth while.

Plate 164.

Tine Renovation of Paspalum Pasture, Maleny.

Kikuyu pastures tend to become rootbound after a number of years' grazing, but this grass also rapidly responds to pasture renovation (Plates 165–166). Rotary hoe and disc plough renovation have both provided promising results and are used, particularly on the Maleny plateau.

Considerable work has been undertaken in renovation and reseeding of pastures infested by mat grass, but to date results are variable and further detailed investigation is required.

Plate 165.

Drastic Disc Plough Cultivation of Kikuyu Sod, Maleny.

Plate 166.

Regrowth of Kikuyu Pasture Following Disc Plough Renovation.

Pasture Contour Furrows.

On pasture slopes ranging from 10% to 25%, the system known as pasture furrowing has proved of value. On such slopes during sudden storms, water run-off may be considerable. The obstruction to water movement provided by contour furrows helps to trap and hold such water and penetration of storm rains into the pasture sod is improved. Most of the hillside country has shallow soil and as a

Plate 167.

Contour Furrowing a Coastal Hillside Pasture of 22% Slope.

result furrows cannot be ploughed deeply; it is necessary in this case to space the furrows fairly closely. On average slopes of 10–15%, furrows are usually ploughed 12–20 ft. apart, with vertical distances between furrows of 2–3 ft. Ploughed furrows may be used to establish other grasses and pasture legumes, and experience has shown that in the average run of seasons worthwhile growth can be obtained from the added soil moisture.

Investigation is being continued to determine the economic usefulness of contour furrowing in pastures. Indications are that contour furrowing will be a very useful supplement to other methods adopted for pasture improvement.

Topdressing.

All pasture lands throughout the district are acid in reaction and are low in available phosphates. Such soil conditions have helped to aggravate the poor growth of grass, while pasture legume growth is particularly poor over a wide area. From analyses of soil samples it is known that the rate of lime or dolomite application required may vary from 10 cwt. to 2 tons per acre and that of superphosphate from 1½ cwt. to 2 cwt. per acre. Topdressing of pastures in the Mary Valley, usually with lime and superphosphate, is a comparatively recent practice and is not yet widely adopted. Beneficial results, particularly with legume establishment, have been achieved in experiments on the use of soil amendments, and in average seasons, reasonable returns can be anticipated, especially where heavy lime dressings are not required.

Where soils are known to be deficient in lime and phosphoric acid, it is recommended that farmers treat small strips with lime or dolomite or with superphosphate as required and observe the response of the treated pastures compared with untreated areas before applications on a wide scale are attempted.

Trace Elements.

On the wet coastal fringe, symptoms of copper deficiency have been observed in stock, and in some horticultural areas additions of molybdenum have been found to be necessary for good growth in certain crops. Where copper sulphate has been applied to soils in association with fertilizers containing nitrogen and phosphate, some very useful growth responses have been obtained with oats and kikuyu pasture. These results have been achieved so far on sandy soil fringing the wallum country.

In the main dairying area, growth of pastures treated with trace elements has not been superior to that of pasture to which lime and superphosphate have been applied. Trace-element investigations, however, are being continued. It is possible that the heavy lime applications often necessary to produce an appreciable response in legume growth may be reduced by using small applications of molybdenum.

Manure-spreading.

Manure-spreading is not widely carried out, but a few progressive dairy-farmers on the Maleny Plateau collect manure and urine from the bails and pigyards and store this material until it is convenient to apply it to pasture. The system usually employed entails gravitation of the manure in liquid form into a suitably lined tank (Plate 168). When the tank is full, the contents are syphoned onto the pasture or spread from a portable tank. The rate of application of this semi-liquid

manure is very heavy. From 10 to 20 tons may be used per acre, and the application is rather slow, but good results have been observed, particularly on unproductive pasture land. The system employed could well be adopted by many farmers, even though levelling and cementing of yards and pens may be fairly expensive. On too many farms cowyard manure is regarded as a nuisance rather than as an asset. Until the problem of the proper collection and distribution of farmyard manure on pasture or cultivation has been solved, no dairy farm can claim to be fully efficient.

Plate 168.

Concrete-lined Farmyard Manure Pit with Sump and Pipe Syphon, Maleny.

The harrowing of paddocks carrying large stock numbers will help to spread manure and promote more even pasture growth. The practice is of particular value for night paddocks.

Subdivision.

Subdivision of large grazing paddocks into smaller areas has been found to be very useful in the dairying districts of the Mary Valley. Dairy cows will not graze large paddocks evenly, and the quick, close cropping in smaller paddocks makes better use of the pasture. Experience has shown that as many night paddocks as day paddocks are required in order to prevent dung contamination of a few paddocks. Paddocks large enough to carry the herd for 3–4 days or nights provide a quick turn-around and maintain a short crisp bite of pasture.

Plate 169.

White Clover in Pasture along the Mary River.

Pasture Legumes.

A number of pasture legumes, both annuals and perennials, have been tried in the Mary Valley; to date, the most promising are white clover, red clover, and lucerne. These legumes will make good growth, particularly where lime and phosphate treatments have been applied, and will provide late-winter and spring grazing prior to the summer flush of normal summer-growing pastures.

Pilate 170.

A White Clover-Rhodes Grass Pasture.

In good seasons, such as 1950, when satisfactory winter and early-spring rain occurs, white clover grows prolifically along the alluvial flats of the Mary River system (Plate 169) and on the Maleny Plateau. The Maleny Plateau, by virtue of its height and close proximity to the sea, enjoys in most years a well-distributed annual rainfall and it is not uncommon to find white clover growing as a perennial. However, in very favourable seasons the growth of white clover at Maleny may be too prolific and cause bloating of ruminants if not carefully grazed.

In many pastures the summer-growing native tick trefoil (*Desmodium triflorum*) and the exotic lespedeza (*Lespedeza striata*) contribute valuable legume balance to summer-growing pasture mixtures. In good seasons these legumes make a valuable showing and they are spreading fairly rapidly in some districts.

In the drier western portion of the Mary Valley area, trial sowings of Townsville lucerne are showing promise and this plant has been able to regenerate successfully over three seasons.

Native pasture legumes are common and include species of *Glycine, Rhynchosia* and *Vigna*. All are summer-growing in habit and make prolific growth in early spring, particularly in association with native pasture grasses.

Despite the presence of native summer-growing legumes and introduced winter species in some localities, the overall position of pasture legumes in the Mary Valley is far from satisfactory. Intensive investigations are necessary in an endeavour to rectify this position.

Weed Problems.

As in most mixed-farming areas, weeds are a problem both in pastures and in cultivated crops.

Blady grass and bracken fern are the most important pasture weeds, but the invasion of pastures by inferior grass species such as the mat grasses (*Axonopus affinis* and *A. compressus*) and sour grass (*Paspalum conjugatum*) is causing much concern at present, particularly on steeply sloping land where cultivation is not practicable. Other troublesome pasture weeds include lantana, wild tobacco (*Solanum auriculatum*), poison peach (*Trema aspera*) and Scotch thistle (*Cnicus lanceolatus*).

Many weeds occur in cultivations, but Noogoora burr (*Xanthium pungens*) and nut grass (*Cyperus rotundus*) are the most serious problems, particularly on the alluvial flats. Johnson grass (*Sorghum halepense*) and turnip weed (*Rapistrum rugosum*) are also very common on some farms.

The availability of hormone-type weedicides has eased the problem of control of those weed species which are susceptible to these compounds, but little progress has been made so far with chemical treatment of blady grass and bracken fern on an economic basis. Where cultivation can be carried out, neither of these weeds is beyond control, but on broken, steep and poorly-cleared country, practical control measures are not available at present.

AGRICULTURAL CROPS.

The wide range of climatic factors and soil types in the Mary Valley favours the cultivation of many crops. The main agricultural crops are grown for use by the dairying and pig industries. The district is not a large exporter of produce from agricultural crops, the trend being to use more and more of these products on the farm each

year. Apart from the large sugar and fruit-growing industries, it is estimated that about 24,000 acres are cultivated annually for agricultural crops.

Maize.

Maize is by far the most important individual grain crop and is also widely grown for green feed. The alluvial flats lend themselves admirably to the successful cultivation of maize (Plate 171). Maize acreages on individual farms are not large, but all farmers with suitable soil grow the crop.

Plate 171.

Well-cultivated, Five-weeks-old Maize in the Mary Valley.

For many years the varietal position was static, being based upon a number of the best available open-pollinated varieties. Improved Yellow Dent, Early Leaming, Star Leaming, Red Nib and Ninety-Day types were most popular and gave reasonable yields. The recent introduction of hybrid-maize varieties has created widespread interest and very encouraging grain yields from these hybrids have been reported from many centres.

The crops are usually grown without fertilizer and are normally hand-harvested as required on the farm. Three or four mechanical maize-pickers are in operation but do not handle a large acreage.

Normal district maize plantings are in the vicinity of 4,500 acres per year, and the yield is approximately 135,000 bushels of grain. At least 95% of this grain is used on farms for stock-feeding purposes.

It is not expected that any large increase in maize acreage will occur, as marginal soil areas are now being planted to the hardier grain sorghums.

Sorghum Group.

Of recent years, greater interest is being taken in growing crops of the sorghum group. This trend is particularly noticeable in respect of grain sorghum. Several header-harvesters are now operating in the district, and some fine crops of grain sorghum have been grown, particularly in the drier areas of Woolooga, Kilkivan and Cinnabar.

The Wheatland variety is popular because of the good yields obtained with it. Grain losses due to birds and insect pests are liable to be heavy, particularly in the coastal districts.

Sweet sorghum and Sudan grass are grown on many farms but do not enjoy widespread popularity. Much greater use should be made of these fodders. Sudan grass is favoured as a grazing crop in the drier areas of Woolooga and Kilkivan.

It is estimated that 3,500–4,000 acres are now sown annually to grain sorghum, sweet sorghum and Sudan grass. Yields of grain sorghum vary from 20 to 40 bush. per acre, with sweet sorghums and Sudan grass yielding from 10 to 20 tons of green material per acre, depending on seasonal conditions.

Plate 172.

A Crop of Victoria x Richland Oats on Alluvial Flat Beside the Mary River.

Millets.

Wide interest is taken in the growing of millets, particularly for green feed. These crops are grown singly or in a mixture with Poona peas. Valuable results have been obtained by using millets for grazing and hay production.

Perhaps the greatest advantage of growing millet crops is the fact that they are early-maturing and can be sown in late spring or early summer for a quick supply of green feed.

The area sown to millets remains fairly constant at 1,200 acres per annum and it is not expected that much increase will occur.

Winter Grazing Crops.

The large area sown to winter grazing crops is an outstanding feature. As all the main pasture species are summer-growing types, the need for winter supplementary grazing crops is clearly apparent.

Oats.—Oats is the most popular and the most widely grown of the winter-cereal grazing crops. It is estimated that 7,200 acres are sown annually, mostly for grazing. Small areas are made into hay or harvested for grain.

There has been a big change in the demand for oat varieties. The old standard varieties, such as Algerian, Belar, Buddah, Fulghum and Sunrise, are all susceptible to heavy crown-rust damage. With the introduction of the new crown-rust-resistant types, such as Vicland (Victoria x Richland) and Fultex (Fulghum x Victoria), farmers

Plate 173.

Oats and Field Peas Oversown on Disc Plough Renovated Kikuyu Pasture.

are changing to these varieties as rapidly as the availability of seed permits. Oats for grazing and hay will always be a very popular crop with dairy farmers in the Mary Valley and these new oat varieties have enhanced the value of this crop.

Barley.—Barley is used by many farmers as a subsidiary grazing crop, with small areas being harvested for grain. Approximately 900 acres are grown annually, the most popular varieties being Skinless and Cape; small sowings of malting barley are occasionally grown for grain. The overall acreage under barley shows no sign of increase.

Wheat.—Wheat is grown both for grazing and for grain production, but the area is small, being approximately 600 acres. Standard dual-purpose varieties such as Warput have been grown with success for a number of years, but recently the rust-resistant variety Lawrence has been used more widely. Most wheat crops are grown for grain, but if seasonal conditions do not favour grain production the crops are used for grazing.

Small areas of a wheat-field pea mixture are also sown for green feed.

Lucerne.

Lucerne is very widely grown along river and creek alluvial flats, both for grazing and for hay production, and some 4,200 acres are under this crop each year. The deep, fertile soils on these flats are very suitable for lucerne-growing and irrigation facilities are readily available.

The district is not a large producer of lucerne hay. Though little of the crop is marketed outside the district, insufficient is stored on farms as insurance against droughts and seasonal shortages. Most farmers could make far greater use of farm-conserved hay, the value of which in drought times is universally recognised.

Plate 174.

A Well-grown Poona Pea Crop, used for Grazing and Green-manure purposes.

Additional interest is being taken in the crop, particularly on the heavier soils where the use of lime and fertilizer has shown responses. Lucerne should also be used more throughout the district as a constituent of pasture mixtures.

The main variety grown is Hunter River Broadleaf, and farmers have found inoculation of the seed to be advantageous in establishing fields.

Miscellaneous Green Crops.

Under this heading are included two useful fodder legumes, Poona peas (Plate 174) for summer culture and field peas for winter. Each year farmers plant from 800 to 1,000 acres of these crops. Both crops

are grown primarily for grazing and green-manure purposes, but when weather conditions are satisfactory, good hay can be made.

As stated previously, Poona peas are often grown in association with millets for summer feed, and in winter, field peas may be mixed with winter cereals. Wider use should be made of these fodder legumes both for stock-feed and for soil-renovation purposes.

Cowcane and Fodder Sugar-cane.

Cowcanes and sugar-canes used for stock fodder are worthy of special mention. Each year farmers have some 600 acres of this fodder crop under cultivation. During the 1951-52 drought, standing crops of cowcane provided excellent reserves of succulent stock fodder for many farmers. Experience in the Gympie district has shown that, as a source of nutritious bulk for dairy cattle, no other crop will yield so heavily and stand in the field so long without serious deterioration.

Much greater use can be made of this crop, particularly along the coastal fringe where frosting is not severe. Farms with 2–3 acres of cowcane are able to withstand long dry spells without stock losses. The varietal position is somewhat confused, but at present the cowcanes 90-Stalk and Improved Fodder Cane, and the sugar-cane variety P.O.J. 2878, are mainly used for this purpose.

Pumpkins.

Pumpkins are grown on many farms but are usually grown for stock-food, chiefly for pigs, rather than for sale. Pumpkins are grown as a rotation crop on alluvial soils but yields are not high. The district acreage is estimated at approximately 2,000.

The variety most commonly grown is Beaudesert or Queensland Blue, with individual preferences in certain areas for cattle pumpkins and grammas.

Potatoes.

Potatoes are not a major crop in the district, but good crops are grown on alluvial flats, particularly where irrigation facilities exist. Individual farm areas are usually small, varying from one to 10 acres. Both autumn and spring crops are grown. It is estimated that the area planted annually does not exceed 400 acres.

Yields per acre are extremely variable and range from 1–3 tons per acre without irrigation to 4–10 tons with irrigation. Factor has been the most popular variety for many years, but of recent years the new varieties Sebago, Sequoia and Saranac have gained increasing favour.

Certified Seed.

The new interest engendered by hybrid maize has encouraged the production of certified hybrid maize seed within the district. So far it has been possible to meet the district demand for hybrid seed and in addition supply a quantity for adjacent districts.

A limited quantity of certified Wheatland grain sorghum has also been grown and produced. The wetter sections of the district, however, are unsuited for the production of sorghum seed of good quailty.

Varieties of certified seed produced in the 1950-51 season were—

Hybrid Maize: Q 499, Q 431, Q 716, Q 717.
Grain Sorghum: Wheatland.

HORTICULTURAL CROPS.

The area is very important for the production of fruit and vegetable crops, and each year the district derives a big income from this source. Pineapples, bananas, papaws and citrus fruits constitute the main fruit crops, and each winter, planting of French beans provides a steady farm income.

Each year some 14,000 acres are cultivated to orchard and plantation fruit crops and vegetables for sale.

FORESTRY.

Valuable forestry reserves and reafforestation plantations are situated throughout the district. In association with forestry projects, extensive sawmilling plants operate for local and export sales of hardwood and pine.

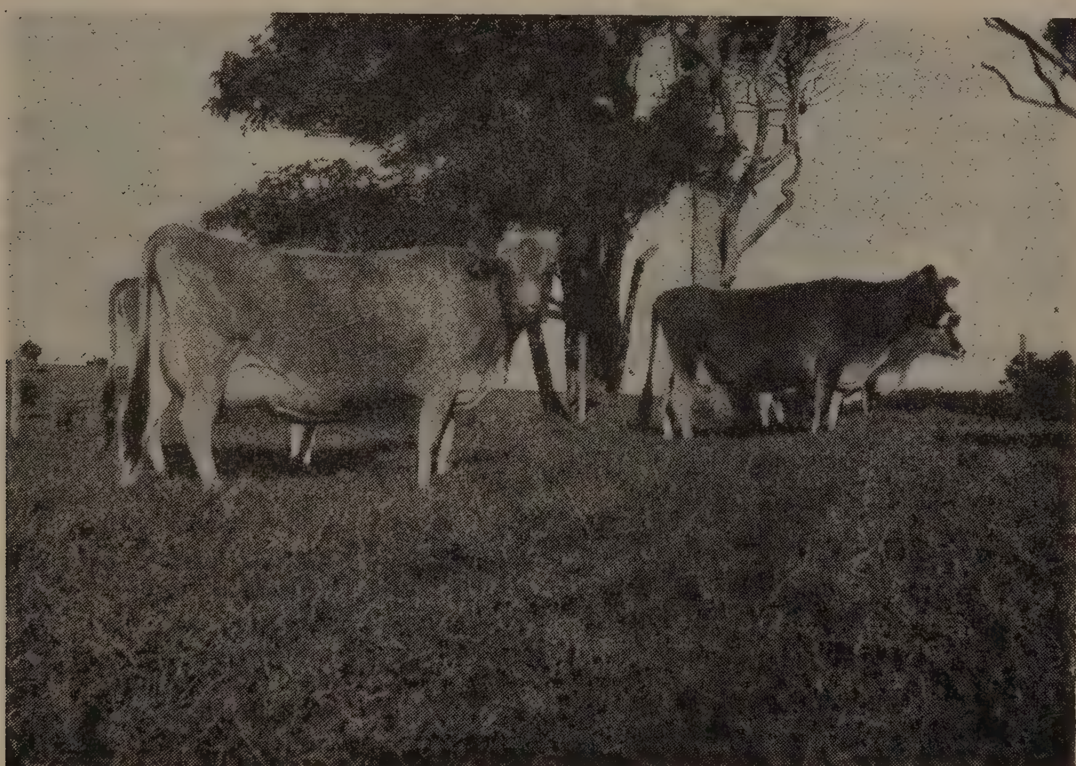


Plate 175.

Dairy Cows in Kikuyu Pasture, Maleny.

DAIRYING AND GRAZING.

As stated earlier, a close link exists between agricultural pursuits and the dairying and pig-raising industries. Farm sizes vary from 100–150 acres in the closely settled areas to 300–700 acres in the drier, open-forest areas. The stock-carrying capacity varies with the type of country concerned. On the good pasture lands of the smaller farms, one beast is carried per three acres on the average, while on the poorer pastures in the drier areas one beast to 10 acres is usual.

Statistical returns show that 235,000 cattle and 35,000 pigs are carried on farms in this area. Of the cattle listed, a small percentage are beef cattle. These beef cattle are maintained mainly in the dry, open-forest area on the western fringes of the district. Both breeding and fattening are carried out, depending on the type of country and feed available.

Dairy production is extensive and provides about 15% of Queensland's total annual butter production. Butter production at the main centres of manufacture in 1949-50 is shown below.

Factory.	Butter Production. lb.
Gympie	7,286,913
Pomona	1,667,745
Cooroy	1,427,514
Eumundi	2,073,461
Maleny	2,701,209
Total	15,156,842

Both the Jersey (Plate 175) and A.I.S. breeds are well represented throughout the district. The former appear to be more adaptable to the smaller farms, while A.I.S. cattle appear to be very well suited to the larger properties in the Woolooga and Kilkivan areas.

In the past the dairying industry has depended mainly on pastures and green-fodder crops for maintaining production. However, the weaknesses of this system have been very evident in drought years such as 1951. At present there is a definite trend towards conservation of hay and storage of grain, and hand-feeding of stock is receiving attention. It is very desirable that farmers with suitable areas of cultivation should adopt some form of fodder conservation.

Labour shortages and high farm wages have hindered expansion of fodder conservation considerably. Due to the high cost of labour and handling facilities, very little interest is shown in silage-making in Mary Valley dairying districts.

From experience gained in the last drought, the most suitable fodder reserves appear to be hay and grain and most reliance must be placed on these. It is anticipated that good prices for dairy products will stimulate a wider and more effective interest in fodder conservation than has been the case hitherto.

Beef cattle are not fed on crops in the district nor are they normally fed with hay or grain. Fattening on native pasture grasses is carried out successfully in most years, particularly on hilly country unsuited to agricultural activities.

Queensland Year Book, 1951.

The twelfth issue of the Queensland Year Book has just been published by the Government Statistician.

The volume contains 429 pages, in which is provided a comprehensive survey of a number of aspects of Queensland life—economic, financial, social and administrative. There are chapters on government, population and health, public justice, social services, land and settlement, production, transport and communication, trade, marketing, prices, employment, public finance and private finance. There are numerous supporting tables, and a convenient summary of statistics appears as an appendix.

The Year Book is available from leading booksellers and from the Government Statistician, Brisbane, for two shillings a copy.

Brucellosis Testing of Swine.

The Department of Agriculture and Stock is operating a scheme whereby pig herds are tested at intervals for the occurrence of swine brucellosis (contagious abortion).

A herd listed by the Department as "brucellosis tested" is one in which all such animals as may be determined by the Director of the Department's Division of Animal Industry have been subjected to two successive tests for brucellosis, at intervals determined by him, without any positive reactors being found.

In order for a herd to be retained on the list of Tested Herds, a semi-annual or annual re-test of the herd, as determined by the Director, is required. If at a re-test any animal gives a positive reaction to the test the herd is removed from the list; it is not listed again until subsequent tests, as determined by the Director, have been carried out.

Full particulars of the Brucellosis Testing of Swine and application forms may be obtained from the Under Secretary, Department of Agriculture and Stock, William Street, Brisbane.

TESTED HERDS.

(AS AT 25th NOVEMBER, 1952.)

Breed.	Owner's Name and Address of Stud.
Berkshire	J. J. Bailey, " Lucydale " Stud, East Greenmount
	S. Cochrane, " Stanroy " Stud, Felton
	Garrawin Stud Farm Pty. Ltd., 657 Sandgate road, Clayfield
	G. Handley, " Handleigh " Stud, Murphy's Creek
	J. L. Handley, " Meadow Vale " Stud, Lockyer
	R. G. Koplick, " Melan Terez " Stud, Rochedale
	O'Brien and Hickey, " Kildurham " Stud, Jandowae East
	E. Pukallus, " Plainby " Stud, Crow's Nest
	G. C. Traves, " Wynwood " Stud, Oakey
	E. Tumbridge, " Bidwell " Stud, Oakey
	Westbrook Farm Home for Boys, Westbrook
	H. W. Wyatte, Rocky Creek, Yarraman
	H.M. State Farm, " Palen Creek," Palen Creek
	A. R. Ludwig and Sons, " Cryna " Stud, Beaudesert
	H. H. Sellars, " Tabooba " Stud, Beaudesert
	F. Thomas, M.S. 373, Beaudesert
	D. T. Law, Trouts Road, Aspley
	C. F. W. and B. A. Schellback, " Redvilla " Stud, Kingaroy
	R. H. Crawley, " Rockthorpe " Stud, via Pittsworth
	F. R. J. Cook, "Alstonvilla," Woolvi, via Gympie
	D. E. and E. C. Apelt, "Thelmur," Oakey
	Mrs. I. M. James, "Kenmore" Stud, Cambooya
	H. L. Stark, "Florida," Kalbar
	J. H. N. Stoodley, " Stoodville," Ormiston
	H.M. State Farm, Numinbah
	V. G. M. and A. G. Brown, "Bardell", Goovigen.
Large White	H. J. Franke and Sons, " Delvue " Stud, Cawdor
	Garrawin Stud Farm Pty. Ltd., 657 Sandgate road, Clayfield
	F. L. Hayward, " Curyo," Jandowae
	J. A. Heading, " Highfields," Murgon
	K. B. Jones, " Cefn " Stud, Pilton
	R. G. Koplick, " Melan Terez " Stud, Rochedale
	R. Postle, " Yarralla " Stud, Pittsworth
	E. J. Bell, " Dorne " Stud, Chinchilla
	L. C. Lobegeiger, " Bremer Valley " Stud, Moorang, via Rosewood
	J. H. G. Blakeney, " Talgai " Stud, Clifton
	H. R. Gibson, " Thistleton " Stud, Maleny
	H.M. State Farm, Numinbah
	K. A. Hancock, " Laurestonvale " Stud, Murgon
	O. H. Horton, Mannuem, Kingaroy

TESTED HERDS—continued.

Breed.	Owners Name and Address of Stud.
Large White—*continued*	V. P. McGoldrick, " Fairymeadow " Stud, Cooroy N. Woltmann and Sons, Wooroolin R. S. Powell, Kybong, via Gympie E. B. Horne, "Kalringal," Wooroolin S. T. Fowler, "Kenstan" Stud, Pittsworth J. A. and J. McNicol, "Camden," Canning Vale, Warwick H. L. Larsen, "Oakway," Kingaroy
Tamworth	S. Kanowski, " Miecho " Stud, Pinelands N. R. Potter, " Actonvale " Stud, Wellcamp D. F. L. Skerman, " Waverley " Stud, Kaimkillenbun A. C. Fletcher, " Myola " Stud, Jimbour Salvation Army Home for Boys, Riverview F. Thomas, M.S. 373, Beaudesert A. J. Surman, Noble Road, Goodna P. V. McKewin, "Wattleglen" Stud, Goombungee Department of Agriculture and Stock, Regional Experiment Station, Kairi P. V. Campbell, Lawn Hill, Lamington E. C. Phillips, "Sunny View," M.S. 90, Kingaroy T. A. Stephen, "Withcott," Helidon W. F. Kajewski, "Glenroy" Stud, Glencoe A. A. Herbst, Bahr Scrub, via Beenleigh R. G. Koplick, "Melan Terez" Stud, Rochedale H.M. State Farm, Numinbah
Wessex Saddleback ..	W. S. Douglas, " Greylight " Stud, Goombungee D. Kay and P. Hunting, " Kazan " Stud, Goodna E. Sirrett, " Iona Vale " Stud, Kuraby C. R. Smith, " Belton Park " Stud, Nara H. H. Sellars, " Tabooba " Stud, Beaudesert H. Thomas, " Eurara " Stud, Beaudesert D. T. Law, Trouts Road, Aspley G. J. Wilson, " Glenbella " Stud, Silverleigh G. J. Cooper, "Cedar Glen", Yarraman J. B. Dunlop, Acacia Road, Kuraby A. Curd, Box 35, Jandowae

HAVE YOUR SEEDS TESTED FREE

The Department of Agriculture and Stock examines FREE OF CHARGE samples representing seed purchased by farmers for their own sowing.

The sample submitted should be representative of the bulk and a covering letter should be sent advising despatch of the sample.

MARK YOUR SAMPLE

Sample of .... seed
Drawn from .... bags
Representing a total of ....
Purchased from ....
Name and Address of Sender
Date..........

SIZE OF SAMPLE

Barley -	8 oz.	Oats -	8 oz.
Beans -	8 oz.	Peas -	8 oz.
Grasses	2 oz.	Sorghum	4 oz.
Lucerne	4 oz.	Sudan -	4 oz.
Millets	4 oz.	Wheat -	8 oz.
Vegetable Seeds -	½ oz.		

SEND YOUR SAMPLE TO—**STANDARDS OFFICER, DEPARTMENT OF AGRICULTURE AND STOCK, BRISBANE.**

The 1952 Pig Meats Carcass Competitions.

F. BOSTOCK, Officer-in-Charge, Pig Branch, and Competition Judge.

THE Australian Meat Board, in association with the Department of Agriculture and Stock and with the co-operation of all sections of the industry, this year conducted its fifth Baconer Pig Carcass Competition on a district basis. Judging and field days in the respective districts were conducted in May at Mareeba, Rockhampton, Toowoomba, and Brisbane.

Prize-winners.

The championship was awarded to Mrs. M. Forde, of the Rockhampton area, for a purebred Large White carcass with a score of 85%. The carcass was well proportioned and of good type, and scored well in all points.

Prize-winners in their respective districts were as follows:—

Prize.	Owner.	Breed.	Weight (lb.)	Points.
		Northern.		
1st	T. H. Cailes	Berkshire	164	84½
2nd	J. B. Smith	Berkshire x Large White	169	84
3rd	R. Clacherty	Berkshire x Large White	153	83
		Central.		
1st	Mrs. M. Forde	Large White	134	85
2nd	N. Holmes	Berkshire	128	81½
3rd	F. N. Baxter	Berkshire	150	81
		Darling Downs.		
1st	G. H. Handley	Berkshire	147	84
2nd	O'Brien and Hickey	Berkshire	148	83½
3rd	L. Puschman	Berkshire	172	83
		South Queensland.		
1st	Q.A.H.S. and College	Berkshire	136	84
2nd	C. A. Wharton	Large White	158	83
3rd	W. G. Eisenmenger	Wessex x (Gloucester Old Spot x Tamworth)	133	82½

Field Days.

Field days were again arranged to coincide with the judging at each district centre and it was very pleasing to note the popularity of these days with the farmers, who gave good support by attending in numbers.

Officers of the Department of Agriculture and Stock, together with the Works Management in each district, went to considerable trouble to make these field days as instructive and interesting as possible. Farmers were afforded the opportunity of inspecting the carcasses entered in the competition, inspecting the bacon factory or meatworks and listening to addresses on subjects dealing directly and indirectly with pig production.

Comments on Entries.

The Hammond System of carcass appraisal was again used in judging. To qualify for entry into the competition, the pig in the first place must have been sired by a purebred boar and the dressed carcass had to weigh not less than 120 lb. and not more than 180 lb.

That the competitions were again a success was borne out by the fact that in all 172 entries were received; of these 149 carcasses were judged and 140 were eligible for competition. This represents an increase over last year of 12 carcasses competing in the competitions and an increase of 13 entries received. No doubt had seasonal conditions been more favourable, the number of carcasses presented for judging would have been greater. Of the nine carcasses disqualified, five were overweight and four underweight.

While the top score (85%) and the average score (70·629%) were not quite so good as last year, competitors are to be congratulated on the general quality of their entries, especially when the unfavourable seasonal and feed conditions experienced are given due consideration.

The hams were not quite so well fleshed as last year; this is unfortunate when it is realised that the ham is one of the highest priced cuts. Farmers should continue to select breeding stock showing good development of hams.

The shoulders again scored well, but continued careful selection is necessary if the present high standard is to be maintained.

Streak or belly did not score so well as last year, and careful feeding and selection will have to be given further consideration, because a streak that is thick and contains a large percentage of flesh adds to the value of the bacon rasher. There were several streaks of very good quality judged.

Eye muscle scored reasonably well, indicating that producers have continued the careful selection of breeding stock and given attention to the rations fed during the early life of the pig.

Backfat development was very fair, but with adverse seasonal conditions, many carcasses were unfinished. This bears out the result obtained in a recent experiment conducted by the Department of Agriculture and Stock, which indicated that an improvement in backfat thickness is possible by increasing the fibre contained in the rations fed to baconer pigs during the finishing period.

Body length scored particularly well and as with the backfat development would appear to indicate that considerable improvement is possible by the feeding of rations containing a larger proportion of fibre than is generally practised.

Leg length, which gives an indication of the quantity of bone contained in the carcass, was only fair, there being a distinct tendency on the part of all breeders to overlook this point, with the result that leg length was too great in a large percentage of carcasses.

Plate 175.

Prize-winners in the Northern District Competition.

The overall score represents a praiseworthy effort on the part of all competitors and as was the case last year the score secured for 1st, 2nd and 3rd places in each district was not below 80%.

From Table 1, which sets out the points scored for each of the five years since the commencement of these competitions, it will be noted that an overall improvement of approximately 10% has been secured in the quality of the carcasses entered for competition.

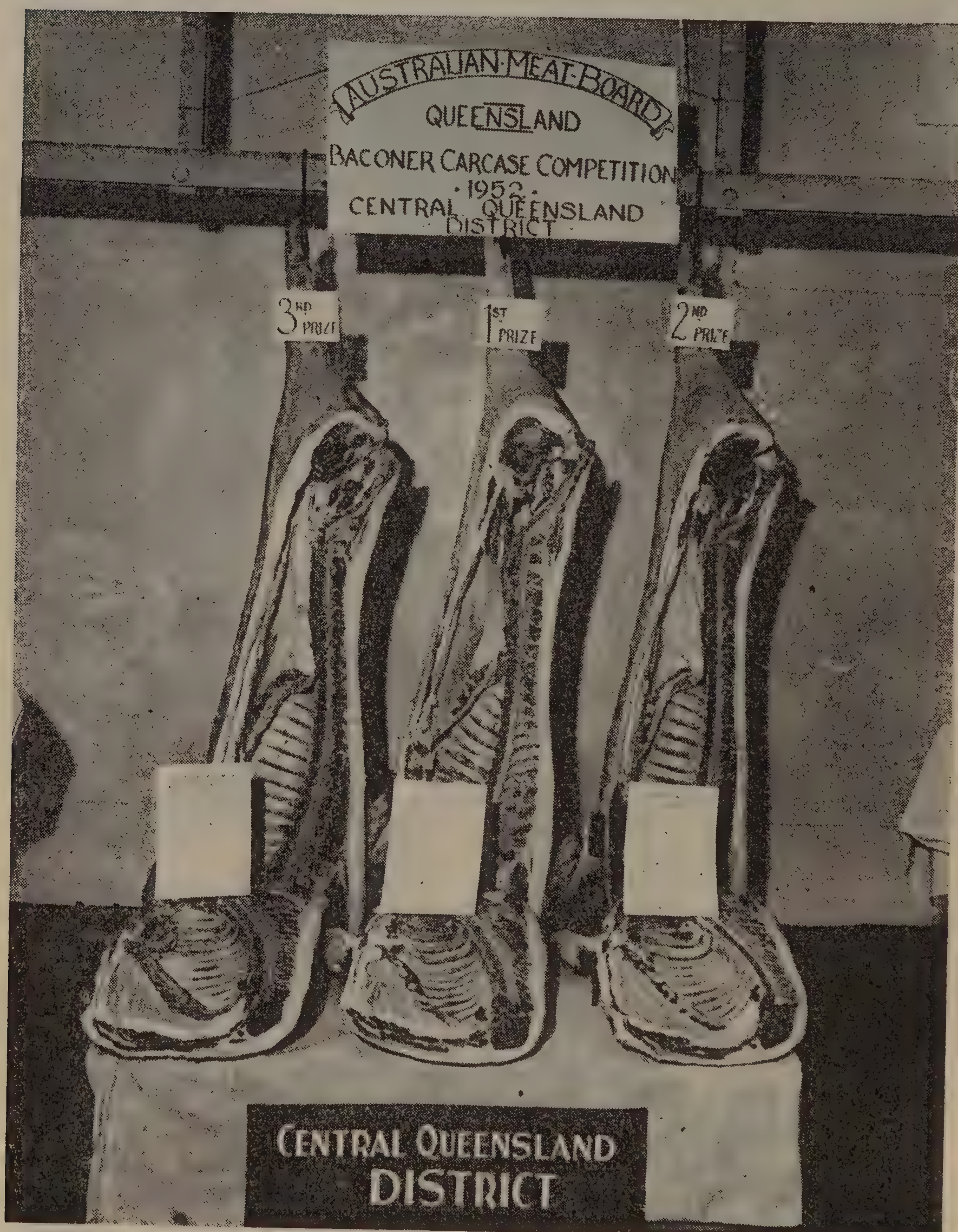


Plate 176.

Prize-winners in the Central District Competition.

Plate 177.

Prize-winners in the Darling Downs District Competition.

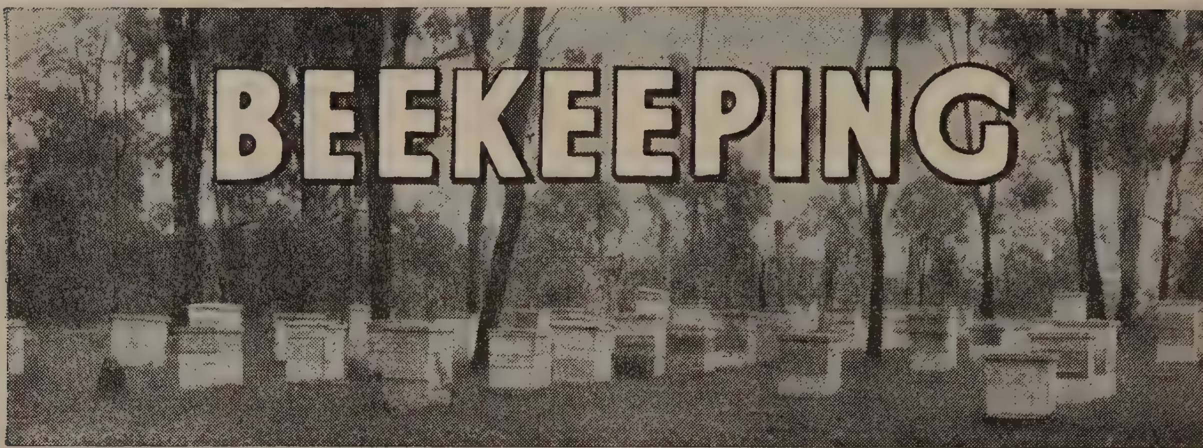
Plate 178.

Prize-winners in the South Queensland District Competition.

TABLE 1.

AVERAGE POINTS FOR EACH SECTION OF JUDGING.

—	Possible Points.	1948.		1949.		1950.		1951.		1952.	
		Average Points Obtained.	Percentage of Possible Points.	Average Points Obtained.	Percentage of Possible Points.	Average Points Obtained.	Percentage of Possible Points.	Average Points Obtained.	Percentage of Possible Points.	Average Points Obtained.	Percentage of Possible Points.
By Inspection—											
Hams ..	8	5·604	70·050	6·27	78·40	6·097	76·213	6·44	80·52	6·286	78·571
Shoulders ..	7	5·562	78·029	5·92	84·57	5·849	83·564	5·92	84·60	5·947	84·959
Streak ..	12	6·764	56·367	5·57	46·40	7·766	64·724	7·41	61·79	6·982	58·185
By Measurement—											
Eye Muscle ..	28	11·775	58·875	18·04	64·42	14·262	50·936	20·15	71·96	19·114	68·265
Backfat Thickness	20	15·489	77·445	15·26	76·30	14·572	72·864	15·45	77·23	14·729	73·643
Body Length ..	20	12·500	44·643	13·06	65·30	13·388	66·941	12·98	64·92	14·814	74·072
Leg Length ..	5	3·111	62·220	3·02	60·40	3·281	65·631	3·21	64·22	2·757	55·142
Totals ..	100	60·805		67·97		65·218		71·57		70·629	



Nosema Disease of the Honeybee.

C. ROFF, Adviser in Apiculture.

NOSEMA disease was recorded for the first time in Queensland in one hive of an apiary near Brisbane, during August of this year. It is an infectious disease of adult honeybees and is found in all the principal beekeeping regions of the world. Individual bees and sometimes colonies die from its effects, but rarely is an entire apiary destroyed.

The causal organism of Nosema disease is a microscopic, single-celled animal parasite *(Plate 179), which during one stage of its life history forms resting bodies or spores. The spores after being ingested by the bee germinate within the stomach, and the resultant new parasites invade the cells lining the inner surface of the mid-intestine, where in 3-5 days they mature and produce a further crop of spores. These pass into the rectum and are ejected with the faeces, which some infected bees abnormally void within the hive. Other bees in the same manner contaminate watering places.

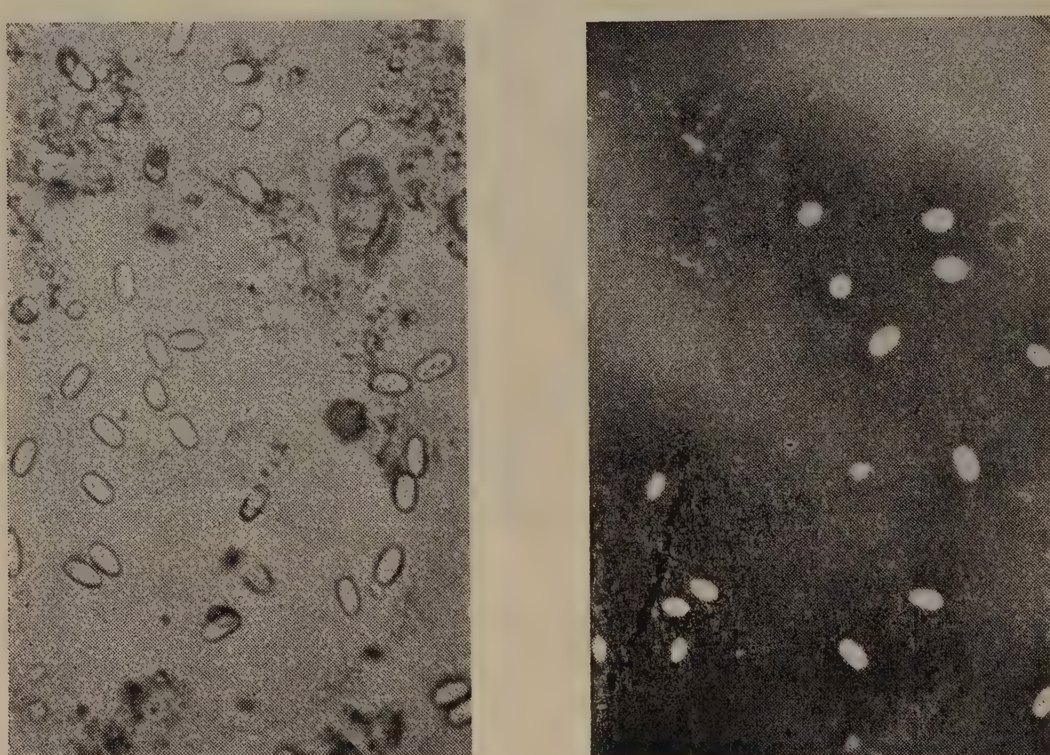


Plate 179.

Spores of *Nosema apis* in Water (left) and in Stain (right). Magnified 600 times (After Dade).

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* *Nosema apis* Zander.

Transmission of Nosema disease to other bees and to other hives is brought about by the ingestion of water and food contaminated with the faecal droppings of infected bees. Robber bees are also responsible for hive-to-hive infections. Overseas experience indicates that the disease is unlikely to be transmitted by tools, or by the clothes or hands of the beekeeper.

Features of the Disease.

(1) All races of honeybees appear to be susceptible to Nosema disease.

(2) Workers are most often infected, although occasionally the parasite has been found in drones and queenbees. Brood is not infected.

(3) Nosema is widespread in cold regions, where the bees are confined to the hives during most of the winter. In warmer regions, where bees may fly almost every day in the year, it is found less frequently.

(4) The occurrence of the disease is seasonal, being most noticeable during late winter and spring. The infection subsides during summer, but increases in late autumn and again reaches a peak during the following late winter and spring. At other times, however, the disease may be aggravated by periods of cold, damp weather.

Plate 180.

Dead Bees, Infected with Nosema Disease, in Front of a Hive.

Symptoms.

Positive diagnosis is dependent upon the presence of spores of *Nosema apis* in the mid-intestine, and this can be ascertained only by microscopic examination. Gross symptoms are of limited value, as apparently healthy bees may, upon microscopic examination of the stomach, show the presence of spores in large numbers. Nevertheless,

the disease may be suspected if the symptoms described below are present, and specimens should then be submitted for examination. It should be kept in mind, however, that other disorders exhibit similar symptoms, and therefore it does not follow that the trouble is Nosema disease if any or all of the following symptoms are present.

(1) The colony is noticeably restless and weak. Dead and dying adult bees may be noticed in front of the hive (Plate 180), or the colony may dwindle slowly in strength due to steady loss of bees which die inconspicuously away from the hive.

(2) Dysentery may occur and this is evidenced by yellow, crusty faecal spots on the hive floor and alighting board.

(3) Heavily infected bees crawl feebly on the ground and are unable to fly or sting. The abdomen is often distended, shiny and hairless; the wings unhooked and askew; and the legs dragged as if paralysed.

Preventive Measures.

The following measures will minimise the incidence and spread of Nosema disease If these are adopted as standard beekeeping practice it is unlikely that the Queensland beekeeper will encounter the disease.

(1) The apiary and flight approach of all hives should be kept clean and dry, and colony strength maintained by providing the food, hive space, and protection required for each particular period of the year.

(2) Stagnant watering places (Plate 181) should be eliminated, as these are easily contaminated with spores from infected bees. If running water is not available and containers for water are used, these should be cleaned and recharged regularly, and *always* placed in sunny positions. The spores of *Nosema apis* in water exposed to sunlight are killed in about three days.

Plate 181.

Watering Places Such as This on the Shaded Southern Side of a Shed are readily Contaminated with Nosema Spores.

Plate 182.

This Apiary is in a Sunny Position and is less Likely to Become Infected with Nosema Disease.

Plate 183.

The Hive in this Shady Location Developed Nosema Disease.

(3) Colonies should be kept separated at least six feet apart to prevent drift, and apiaries should be situated where they will obtain full sunlight (Plate 182). Nosema disease is more likely to occur in apiaries situated in shade or partial shade with attendant dampness (Plate 183).

(4) Beekeepers should ensure that they do not obtain queenbees, colonies, nuclei, or swarms from an infected apiary. As a precautionary measure, queenbees received from elsewhere in Australia should be transferred on arrival to a clean cage and the escort bees should be replaced by young bees from within the apiary, before introduction to a colony. The old cage, together with any candy it may contain, and the escort bees should be burnt. This procedure is standard quarantine practice for all consignments of queenbees received from overseas.

Treatment of Infected Colonies.

Strong colonies with a mild infection often recover. However, colonies which are weakened seriously by the disease or which die out from its effects should be handled in a manner which insures eradication as is described below.

(1) The destruction of diseased colonies should take place in the evening when all bees are in the hives.

(2) Dig a small pit suitable to burn the bees to be destroyed.

(3) Kill all the surviving bees in the diseased hives with calcium cyanide; about two teaspoonfuls of the poisonous powder should be put through the entrance of each hive before closing it. *Extreme care should be taken to avoid inhaling the poisonous gas given off by the cyanide.*

(4) Build a fire in the pit, and as soon as it is burning well, add the bees that have been killed by the calcium cyanide and also any that have died previously from the disease.

(5) Scrape the inside surfaces of the various parts of the hives and burn the debris.

(6) After all diseased material has been burnt, spade the ground down, refill the pit, and pack well.

(7) Render all the beecombs down for wax. The Nosema organism is killed at the temperature of melting beeswax.

(8) Sterilize the contaminated hives, frames and other hive parts by either boiling for half an hour in 1% caustic soda solution or scorching all the inner surfaces, edges and alighting boards to a dark-brown colour with a blow torch.

(9) Turn over the soil beneath and around the infected hives and cover with quicklime.

Legislative Requirements.

Under *The Apiaries Act of* 1947 it is provided that any beekeeper in whose apiary any disease appears shall immediately notify, in writing, the Under Secretary, Department of Agriculture and Stock, Brisbane.

Irrespective of the legal requirements, any beekeeeper who notices unusual bee symptoms in his apiary should, for his own sake, communicate with the Department in order that assistance may be given.

Disease Samples.

When sending samples for examination the following requirements should be observed.

(1) At least 20 bees are necessary for diagnosis and these should preferably be alive or recently dead. Dried-up bees are useless

(2) Mail the sample in a wooden or strong cardboard box. Do not use a tin or glass container

(3) The package should bear the name and address of the sender and be accompanied by an explanatory letter.

TUBERCULOSIS-FREE CATTLE HERDS.
(AS AT 25th NOVEMBER, 1952.)

Breed.	Owner's Name and Address of Stud.
Aberdeen Angus ..	The Scottish Australian Company Ltd., Texas Station, Texas
	F. H. Hutton, "Bingegang," Dingo
A.I.S...	F. B. Sullivan, "Fermanagh," Pittsworth
	D. Sullivan, "Bantry" Stud, Rossvale, *via* Pittsworth
	W. Henschell, "Yarranvale," Yarranlea
	Con. O'Sullivan, "Navillus Stud," Greenmount
	H. V. Littleton, "Wongalea Stud," Hillview, Crow's Nest
	J. Phillips and Sons, "Sunny View," Benair, via Kingaroy
	Sullivan Bros. "Valera" Stud, Pittsworth
	Reushle Bros., "Reubydale" Stud, Ravensbourne
	H. F. Marquardt, "Chelmer" Stud, Wondai
	W. G. Marquardt, "Springlands," Wondai
	A. C. and C. R. Marquardt, "Cedar Valley," Wondai
	A. H. Sokoll, "Sunny Crest" Stud, Wondai
	W. and A. G. Scott, "Welena," A.I.S. Stud, Blackbutt
	G. Sperling, "Kooravale" Stud, Kooralgin, via Cooyar
Ayrshire	L. Holmes, "Benbecula," Yarranlea
	J. N. Scott, "Auchen Eden," Camp Mountain
	"St. Christopher's and Iona" Studs, Brookfield Road, Brisbane
	E. Mathie and Son, "Ainslie" Ayrshire Stud, Maleny
Friesian	C. H. Naumann, "Yarrabine Stud," Yarraman
Guernsey	C. D. Holmes, "Springview," Yarraman
	A. B. Fletcher, Cossart Vale, Boonah
Jersey	J. S. McCarthy, "Glen Erin Jersey Stud," Greenmount
	J. F. Lau, "Rosallen Jersey Stud," Goombungee
	G. Harley, Hopewell, Kingaroy
	Toowoomba Mental Hospital, Willowburn
	Farm Home for Boys, Westbrook
	F. J. Cox and Sons, "Rosel" Stud, Crawford, Kingaroy Line
	R. J. Browne, Hill 60, Yangan
	P. J. L. Bygrave, "The Craigan Farm," Aspley
	R. J. Crawford, "Inverlaw Jersey Stud," Inverlaw, Kingaroy
	P. H. F. Gregory, "Carlton," Rosevale, *via* Rosewood
	E. A. Matthews, "Yarradale," Yarraman
	A. L. Semgreen, "Tecoma," Coolabunia
	G. & V. Beattie, "Beauvern," Antigua, Maryborough
	L. E. Meier, "Ardath" Stud, Boonah
	A. M. and L. J. Noone, "Winbirra," Stud, Mt. Esk Pocket, Esk
	W. S. Conochie and Sons, "Brookland" Stud, Sherwood Road, Sherwood
Polled Hereford ..	W. Maller, "Boreview", Pickanjinnie

PLANT PROTECTION

White Wax Scale on Citrus.

T. MANEFIELD, Assistant Entomologist, Science Branch.

IN recent years white wax scale * has become the major scale insect pest of citrus in coastal districts of southern Queensland, and has caused some concern in inland areas during years of excessive rainfall. It also occurs on a wide variety of other introduced and native shrubs and trees. An unsightly black deposit on the foliage, twigs and fruit is constantly associated with the insect. This deposit, known as ''sooty mould'', is composed of the massed threads of a number of fungi which are not parasitic on the plant but grow in the sugary secretion or honey-dew produced by the scale insect. The presence of the mould on fruit is one of the main reasons why control of this pest is necessary.

Habits and Life History.

Each stage of the insect secretes a protective white waxy material, which in the adult stage forms a globular covering up to a quarter of an inch thick and three-eighths of an inch in length, the colour becoming slightly grey with age. The newly hatched scale larvae are free-moving but soon settle, usually on young twigs, and secrete a wax covering fringed with rectangular projections. Further wax produced over the body becomes conical, then globular, later extending outwards over the fringe when the adult shape is assumed. With heavy infestations and fusion of the wax, the outlines of individual scales are lost, the twigs becoming covered with an irregular coat of wax (Plate 184).

At maturity the insect body is full of eggs. These are laid into the space beneath the insect, the body wall and wax providing a protective covering until hatching. Life history studies have shown that there is a prolonged major hatch commencing in September and carrying through until early January, with a peak between late November and early December. Minor hatchings, however, have been recorded at other times of the year except late summer.

Control.

The best method for preventing the development of sooty mould is to eradicate the white wax scale. Timing of spray application and complete coverage are two essentials for the successful control of this insect In *coastal districts* trees should be sprayed in *early December* with the following mixture—

20 lb. washing soda (or 7½ lb. soda ash);
1½ pints detergent† (34-40% active ingredients);
100 gallons water.

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* *Ceroplastes destructor* Newst.

† The detergent used in successful Departmental experiments against white wax scale contained 34 per cent. sodium secondary alkyl sulphate.

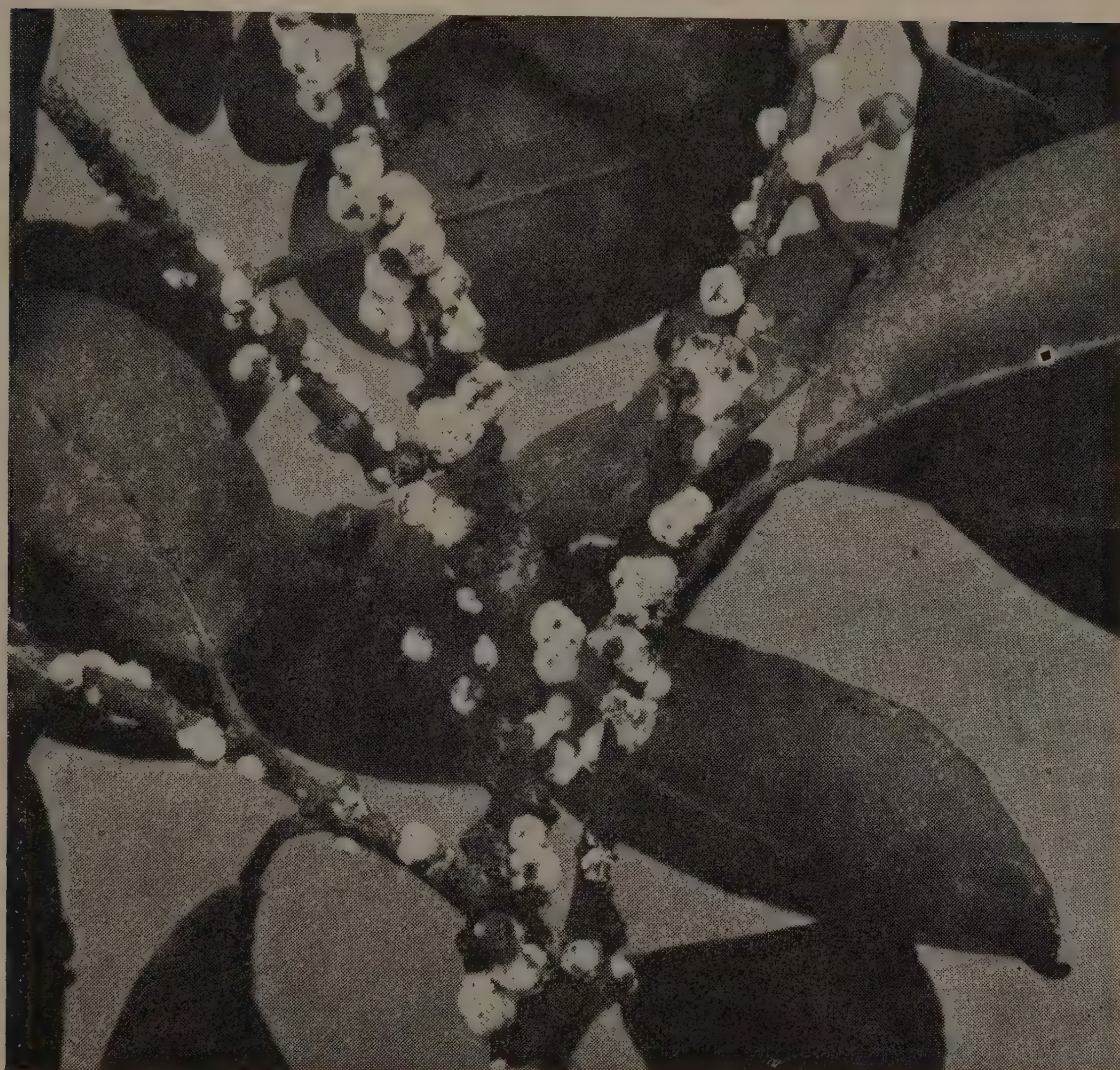

Plate 184.

White Wax Scale and Sooty Mould on Citrus.

In *inland areas,* control is rarely necessary as the normal high summer temperature and low humidity cause the wax to melt, thus effecting a natural control. However, if control measures are necessary, the trees should be sprayed in *early December* with the above mixture, adding 2½ *gallons of white oil* for the control of red scale.*

For the home gardener, mechanical treatment such as brushing gives a quick and efficient control of this pest on small trees.

Cleaning the Fruit.

Should it be necessary to remove sooty mould from fruit, this may be done efficiently in the packing shed by the use of one of the modern detergents. The fruit should be dipped in a 1 in 2,000 solution, brushed, and then allowed to dry well before being packed.

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* *Aonidiella aurantii* (Mask.).

Common Bean Mosaic Yield Trial, 1952.

J. C. JOHNSON, Assistant Pathologist, Science Branch.

SINCE the first published account of the occurrence of common bean mosaic in Australia in 1933*, green bean growers have often been warned of the serious effect this disease may have upon the vigour and yield of their crops. There has, however, been no statement of the actual extent to which the widely grown variety Brown Beauty may be affected and it was for this reason that the trial described here was undertaken. The effect of the disease upon two susceptible strains of Brown Beauty (Nos. 15 and 28) was compared with that on strain 17, a recent selection made by the Horticulture Branch which has been shown in glasshouse trials to be immune to common bean mosaic.

Plate 185.

Common Bean Mosaic. View of an inoculated plot (E4, centre) with healthy rows on each side. At this time the infected plants were showing signs of recovery.

Since it was known that plants of field-run Brown Beauty give variable reactions to mosaic infection, single plant progenies were used to obtain more uniform responses. By this means it was considered that differences due to infection alone could be observed, and that other differences due to variation in plant type would be largely eliminated. These single plant progenies have been shown to be pure lines. The insect vector of the virus is generally more active in the spring months and it was hoped that cross-inoculation between plots would be kept to a minimum by sowing in March. However, the aphid vector did appear towards the harvesting period, and some contamination of the uninoculated plots occurred.

Experimental Results.

The experiment was carried out at the Redlands Experiment Station and with the assistance of the Station staff. Plots were arranged in randomised blocks, and replicated eight times. These plots were single

* C. J. Magee, Plant Disease Leaflet No. 57, New South Wales Department of Agriculture, 1933.

rows 10 feet long and containing approximately 30 plants; single-row buffers were left to separate the experimental rows. Half of the total number of plots of each strain were artificially infected in the field by rubbing a mixture of freshly prepared infected bean sap and carborundum powder onto each of the two primary leaves immediately after they had unfolded. This treatment gave 100% infection of susceptible plants which was apparent six days after the treatment had been carried out.

The symptoms of the disease became very noticeable in the inoculated plots of strains 15 and 28 and continued to increase in severity for 10-15 days after they had been infected. In comparison the uninoculated rows at this time showed marked vigour. However, in the period that followed until harvesting, the difference between infected and healty plots gradually lessened (Plate 185) and by the end of this time it was impossible to distinguish between them.

The plots were harvested three times, with most of the crop coming from the first pick. Yield data based on both first and total picks are presented in Table 1. There was a reduction in yield so far as the two susceptible strains were concerned, while strain 17 showed no reduction. This effect was most noticeable when yield figures for the first pick only are compared.

TABLE 1.

MEAN YIELDS (OUNCES PER PLOT).

Strain.	Treatment.	First Pick.	Total Pick.	Per Cent. Reduction.	
				First Pick.	Total.
17	Uninoculated ..	90·8	105·9	..	..
17	Inoculated ..	90·0	106·5	0·9	−0·6
15	Uninoculated ..	69·0	85·5	..	..
15	Inoculated ..	58·8	78·8	14·8*	7·9
28	Uninoculated ..	57·0	76·0	..	..
28	Inoculated ..	48·4	68·8	15·1*	9·5

* = Significant at 5% level.

Discussion.

The fact that first pick figures showed significant differences while total pick figures did not was due to several contributing factors which were readily observed during the course of the experiment. The first was the gradual recovery of infected plots. This appears to be due to a development of greater tolerance towards the presence of the virus subsequent to the first marked reaction. The recovery of infected plants which has been observed to occur many times in glasshouse tests carried out under diverse growing conditions supports this explanation. The second factor was the failure to restrict infection to the inoculated plots. The aphid vector of mosaic was first noticed just prior to harvesting and was probably present for some time before then. When harvesting was complete, all plots and guard rows were tested for infection, and only plots of strain 17 and one section of the guard rows out of 12 such sections were found to be free. This testing was done in the glasshouse, using a comprehensive leaf-sampling technique and suitable indicator plants.

So far as the Brown Beauty variety is concerned, infection in the field is very difficult to detect, and diagnosis can only be made with certainty by transmission to indicator plants in the glasshouse. It was observed that another influence was of importance in obscuring mosaic infection—this was injury caused by cold, dry winds. These were of rather frequent occurrence during the course of the experiment. They caused leaf cupping and twisting in all of the plots, and leaf differences between infected and non-infected rows were obscured in a few days (Plate 186.)

Plate 186.

Common Bean Mosaic and Wind Damage of Bean. Upper row, two wind-damaged and one healthy leaf; lower row, common bean mosaic.

Conclusions.

Under the conditions of this experiment, two susceptible strains of Brown Beauty beans showed a yield reduction of approximately 15% on the main pick when infected with common bean mosaic, while another strain which is fully resistant showed no yield reduction. Field-run Brown Beauty so far tested shows a mixture of susceptible, tolerant and immune types in fairly equal numbers, and it is therefore unlikely that any large losses have occurred with mosaic in this variety.

Since the choice of the susceptible strains used in this experiment was made from a limited number of such strains that were available at the time, the losses recorded do not necessarily represent the maximum possible. The yield reduction is, however, sufficient to warrant careful attention to resistance when breeding or selecting new lines of beans.

Herd Production Improvement Scheme.

Report on Group Herd Recording for the Year Ending September 30, 1951.

S. E. PEGG, Chief Adviser (Herd Recording).

AS a result of the severe drought conditions experienced throughout most of the dairying districts of the State during 1951 from March onwards the average production of cows for the herd recording year ended 30 September, 1951, was lower than in the previous year, as shown in Table 1.

During the year there were 45 groups in operation, but results of completed lactations were obtained from 814 herds in 40 groups only. Again this year all cows with completed lactations up to a maximum of 270 days were included even though a number had very short lactation periods.

Table 1 gives, according to age groups, the number of cows, their average production of milk and butterfat, and for comparison the average yield of butterfat for 1949-50 and 1948-49.

TABLE 1.

Average Production of Cows Which Completed Lactation Periods of 270 Days or Less.

Age Group.	Number of Cows.	Average Milk Yield.	Average Test.	Average Butterfat, 1950–51.	Average Butterfat, 1949–50.	Average Butterfat, 1948–49.
		Lb.	%	Lb.	Lb.	Lb
2 years ..	2,956	2,748	4·5	123	131	136
3 years ..	2,113	3,069	4·5	137	151	140
4 years ..	1,651	3,471	4·4	154	162	148
Mature ..	7,330	3,588	4·4	156	169	160
Unknown ..	12,748	3,303	4·4	145	146	139
All Ages ..	26,798	3,312	4·4	146	152	144

It will be seen that the average production of butterfat was 6 lb. below the 1949-50 average, the decrease being attributed to, firstly, the effect of drought and secondly, the lower production of cows in new

herd recording groups which were not included in the previous year's averages; most of these groups were situated in areas which were seriously affected by drought conditions.

The report on dairy cattle and milk production in Queensland issued by the Government Statistician shows the average production of milk per cow in Queensland in 1950-51 as 284 gallons. The period which the Statistician's report covers ended on 31 March, 1951, and the effects of adverse seasonal conditions which prevailed later in the year are not reflected to the extent that they are in this report. Using the same average butterfat content (4.3%) as that for the recorded cows, the comparison is:—

	Milk. lb.	Butterfat. lb.
Statistician's average for all cows in Queensland	2,840	122
Average of all recorded cows	3,312	146

Effect of Length of Lactation.

It is illuminating to compare the average production of cows which had a full lactation period of 270 days with those which had a lactation period of less than 270 days. Details are given in Tables 2 and 3.

TABLE 2.

AVERAGE PRODUCTION, ACCORDING TO AGE, OF COWS WHICH MILKED FOR THE FULL LACTATION PERIOD OF 270 DAYS.

Age Group.	Number of Cows.	Average Milk Yield.	Average Test.	Average Butterfat.
		Lb.	%	Lb.
2 years	678	3,957	4·5	178
3 years	555	4,202	4·6	191
4 years	443	4,475	4·5	203
Mature	1,869	4,728	4·5	210
Unknown	3,104	4,493	4·4	200
All Ages ..	6,649	4,479	4·5	200

TABLE 3.

AVERAGE PRODUCTION OF COWS WITH LACTATION PERIODS OF LESS THAN 270 DAYS.

Age Group.	Number of Cows.	Average Milk Yield.	Average Test.	Average Butterfat.
		Lb.	%	Lb.
2 years	2,278	2,388	4·5	107
3 years	1,558	2,665	4·4	118
4 years	1,208	3,103	4·4	136
Mature	5,461	3,198	4·3	138
Unknown	9,644	2,920	4·4	128
All Ages ..	20,149	2,927	4·4	128

These tables show that the average production of cows which completed a lactation of nine months was 200 lb. butterfat, compared with 128 lb. for cows with a lactation period of less than nine months—a difference of 72 lb.

The difference in production stresses the necessity of concentrating on breeding animals which will milk for at least nine months and also the necessity of providing sufficient feed to enable them to continue producing over that period. An amount of 72 lb. butterfat is equivalent to 88 lb. commercial butterfat, which at the ruling price of 3s. 6d. per lb. is valued at £15 8s.

Only 6,649 cows (24·8%) completed a full 270-days lactation period, the low percentage undoubtedly being attributable to a large extent to the adverse seasonal conditions which prevailed.

Value of Continuous Recording.

Table 4 shows the average production of cows in each herd recording group.

TABLE 4.

DETAILS OF HERDS RECORDED AND PRODUCTION, 1950-51.

Group.	Number of Herds.	Number of Cows.	Average Milk Yield.	Average Test.	Average Butterfat, 1950–51.	Average Butterfat, 1949–50.	Average Butterfat, 1948–49.
			Lb.	%	Lb.	Lb.	Lb.
Beaudesert ..	20	1,067	3,883	4·4	170	160	129
Biggenden ..	19	432	2,435	4·3	105	..	..
Boyne Valley ..	11	653	2,299	4·4	101	..	..
Burncluith ..	14	393	2,642	3·8	100	..	..
Cedar Pocket ..	20	674	3,275	4·9	162	151	132
Cooroy No. 1 ..	20	978	3,114	4·7	145	153	121
Cooroy No. 2 ..	25	819	3,014	4·4	133	130	102
Eungella	18	222	2,335	4·5	106	131	..
Goomeri	26	895	2,775	4·2	117	129	121
Gympie No. 1 ..	23	654	2,657	4·6	122	125	..
Kenilworth ..	22	871	3,442	4·6	157	164	131
Kilcoy	21	1,018	2,702	4·6	124	120	113
Killarney	23	402	3,906	4·4	171	154	161
Kingaroy No. 1 ..	24	830	3,213	4·2	136	150	150
Kingaroy No. 2 ..	26	882	3,463	4·0	138	147	120
Malanda No. 1 ..	22	783	4,493	4·3	195	180	163
Malanda No. 2 ..	7	145	5,262	3·9	207	166	..
Maleny No. 1 ..	21	806	3,459	4·9	170	176	155
Maleny No. 2 ..	15	540	3,771	4·7	176	197	145
Mapleton-Kureelpa	19	517	2,954	4·6	137	..	..
Miles	19	900	3,291	4·1	136	121	..
Millaa Millaa ..	24	634	4,112	4·5	186	178	153
Miva-Theebine ..	18	734	2,656	4·8	127	126	102
Monto	20	1,074	3,702	4·3	159	156	160
Mount Tamborine	24	735	3,122	4·7	147	..	..
Mundubbera ..	16	325	1,603	4·0	64	..	..
Oakey No. 1 ..	19	481	3,257	4·1	135	149	184
Oakey No. 2 ..	15	586	4,442	4·3	191	179	186
Oakey No. 3 ..	17	808	4,090	4·0	163	156	149
Pittsworth ..	18	498	4,621	4·0	186	..	..
Pomona	20	686	2,772	4·8	133	153	118
Ravenshoe ..	18	378	3,505	4·6	160	144	..
Roadvale	23	692	3,278	4·5	149	..	..
Tansey	21	1,019	3,032	4·4	132	..	..
Toogoolawah ..	25	540	2,911	4·4	129	128	119
Toowoomba No. 1	21	557	3,793	4·6	174	156	154
Toowoomba No. 2	32	666	3,546	4·2	150	154	148
Wallaville ..	20	389	1,441	4·4	64	..	..
Warra	24	948	3,629	4·1	149	133	..
Warwick	24	568	3,815	4·3	166	179	190

Several groups which have retained a considerable number of the the original members since the commencement of operations have continued to show improvement in the average production of butterfat. Production in the Beaudesert group over the last three years has been:—

1948-49	129 lb.
1949-50	160 ,,
1950-51	170 ,,

Cedar Pocket is another group which has shown significant increases—from 132 lb. butterfat in 1948-49, to 151 lb. in 1949-50, to 162 lb. in 1950-51.

There are also numerous instances where the average production of individual herds has shown a progressive improvement. Some examples of the improvement which has been achieved, despite the adverse season of 1950-51, are shown in Table 5.

TABLE 5.

Improvement Made in Average Production of Four Herds.

Herd.	1948–49.		1949–50.		1950–51.	
	Number of Cows.	Butterfat.	Number of Cows.	Butterfat.	Number of Cows.	Butterfat.
		Lb.		Lb.		Lb.
A.	49	137	53	169	44	221
B.	144	126	100	169	122	176
C.	21	98	36	108	32	139
D.	105	104	96	125	111	132

The improvement in the average production per cow and total production for the farm as shown in Table 5 indicates the value of continuous recording. Some dairymen are inclined to record for a year or two, then cease and recommence when they again have a number of young animals in the herd. Other farmers, after recording for a period, express the desire to record heifers only.

It should be realised that the worth of a cow to its owner should be measured by her lifetime production. All too frequently it has been found that animals which showed great promise of being good producers when recorded as heifers have failed to reach expectations; these animals can only be revealed by continuous recording.

By recording continuously, farmers have a regular check on the production performances of individual cows and are able to determine which animals combine the five qualities sought—sound milk and butterfat production, fertility, resistance to disease, long working life, and good milking temperament.

Members of a herd recording group also have a continuous check on their system of feeding, breeding and management, and are able to assess quickly the value of any changes in husbandry.

Production According to District.

Table 6 gives the average production of cows according to districts, and Table 7 gives a further analysis.

TABLE 6.

Average Production, According to District, of Cows Which Completed Lactation.

District.	Number of Herds.	Number of Cows.	Average Production, 1950–51.			Average Butterfat Production.	
			Milk.	Test.	Butterfat.	1949–50.	1948–49.
			Lb.	%	Lb.	Lb.	Lb.
Eastern Downs ..	169	4,566	3,939	4·2	167	162	173
Western Downs ..	57	2,241	3,320	4·1	135	134	..
South-eastern Queensland ..	316	11,330	3,150	4·6	146	149	128
South Burnett ..	97	3,626	3,115	4·2	131	140	131
Central Burnett ..	35	757	2,078	4·2	87	..	..
Upper Burnett ..	20	1,074	3,702	4·3	159	156	160
Port Curtis ..	31	1,042	1,979	4·4	87	..	..
Mackay	18	222	2,335	4·5	106	131	..
Atherton Tableland	71	1,940	4,234	4·4	186	172	160

TABLE 7.

Average Butterfat Production of the Lowest and Highest Herds in Each of the Main Districts According to Herd Size.

District.	Size of Herd.									
	1–10 Cows.		11–20 Cows.		21–50 Cows.		51–100 Cows.		Over 100 Cows.	
	Lowest.	Highest.	Lowest.	Highest.	Lowest.	Highest.	Lowest.	Highest.	Lowest.	Highest.
	Lb.	Lb.	Lb.	Lb.	Lb.	Lb.	Lb.	Lb.	Lb.	Lb.
Eastern Downs	13	263	75	293	93	264	99	246	141*	141*
Western Downs ..	56	189	41	177	54	216	62	174	169*	169*
South-eastern Queensland	12	182	30	269	58	268	71	230	98	176
South Burnett	10	184	17	222	46	229	92	162	132	147
Central Burnett ..	19	88	55	106	43	92	47	51	..	..
Upper Burnett ..	53*	53*	91	150	95	223	117	213	159*	159*
Port Curtis	12	85	25	94	48	144	45	118	82	92
Mackay	20	196	77	157	101	108	..	..	..	..
Atherton Tableland ..	12	259	41	241	94	268	136	287	..	..

* Indicates only herd in that herd size in district.

It will be noted that the average butterfat production of the herds covers an extremely wide range. The lowest is 10 lb. and the highest 293 lb., a difference of 283 lb., indicating that with an improvement in the standard of farm management on lower-producing farms a considerable increase in production is possible.

Some of the average production figures of herds in the 1-10 cow group are extremely low. This is due to only a few cows having a complete lactation during the period and as the lactation periods were short owing to the drought, average production is hardly a true reflection of the productive capacity of the herd.

Production by Age and District.

The cows which completed lactations are grouped according to age and butterfat yield in Table 8. It will be noted that of the 26,798 cows which completed lactations, 6,874 (25.6%) produced less than 100 lb. butterfat; over 400 lb. was produced by 27 cows, of which five, all located on the Atherton Tableland, produced over 450 lb. Some particulars concerning these cows follow:—

Mr. A. R. Cornish's A.I.S. cow "Judy" was born on 16/12/43 and for her 1950-51 lactation calved on 20/8/50. She produced 15,030 lb. milk and 546 lb. butterfat, with an average butterfat content of 3.6%.

Mr. R. S. Griffiths' A.I.S. cow "Envy" produced 8,685 lb. milk and 500 lb. of butterfat in 270 days, the average butterfat content being 5.7%. She was born on 26/9/44 and calved on 2/6/50 for the 1950-51 lactation.

TABLE 8.

AVERAGE BUTTERFAT PRODUCTION ACCORDING TO AGE.

Age Group.		Under 100 lb	100–149 lb.	150–199 lb.	200–249 lb.	250–299 lb.	300–349 lb.	350–399 lb.	400–449 lb.	450–499 lb.	Over 500 lb.
2 years ..	No.	1,064	914	693	224	53	7	1	..	..	..
	%	35·00	30·92	23·44	7·58	1·79	0·24	0·03	..	..	..
3 years ..	No.	596	645	550	239	54	22	7	..	..	..
	%	28·21	30·53	26·03	11·31	2·56	1·04	0·33	..	..	..
4 years ..	No.	381	417	451	259	101	32	6	4	..	..
	%	23·07	25·26	27·32	15·69	6·12	1·94	0·36	0·24	..	..
Mature ..	No.	1,496	1,993	2,039	1,162	461	141	26	10	1	1
	%	20·41	27·19	27·82	15·85	6·29	1·92	0·35	0·14	0·01	0·01
Unknown ..	No.	3,326	3,441	3,249	1,820	691	173	37	8	2	1
	%	26·09	26·99	25·49	14·28	5·42	1·36	0·29	0·06	0·015	0·008
All Ages ..	No.	6,874	7,418	6,981	3,695	1,354	372	77	22	3	2
	%	25·65	27·68	26·05	13·79	5·05	1·39	0·29	0·08	0·01	0·007

Mr. J. K. English's A.I.S. cow "Beauty" produced 12,480 lb. milk and 489 lb. butterfat in a lactation period of 240 days, the average butterfat content being 3.9%. The lactation period was not completed, as Mr. English withdrew his herd from test. "Beauty" was six years of age when she calved on 20/9/50.

Mr. A. R. Cornish's A.I.S. cow "Fairy 3rd" produced 12,930 lb. milk and 466 lb. butterfat with an average butterfat content of 3.6%, in a lactation period of 240 days. "Fairy" was six years of age when she calved on 27/9/50.

Mr. R. S. Griffiths' A.I.S. cow "Idaho" produced 8,280 lb. milk of an average butterfat content of 5.6%, to yield 464 lb. butterfat. She was born on 21/11/43 and calved on 18/10/50 for the 1950-51 lactation.

Table 9 shows the herds grouped according to butterfat production. It will be seen from this table that 11.2% of the herds averaged over 200 lb. of butterfat compared with 9.5% in 1949-50. This is a very pleasing improvement, particularly in view of the serious drought conditions.

TABLE 9.

HERDS GROUPED ACCORDING TO AVERAGE BUTTERFAT PRODUCTION.

District.		Total No. of Herds.	Under 100 lb.	100–149 lb.	150–199 lb.	200–249 lb.	250–299 lb.	Over 300 lb.
Eastern Downs	No.	169	18	48	68	30	5	..
	%	..	10·65	28·40	40·24	17·75	2·96	..
Western Downs	No.	57	16	21	17	3	..	..
	%	..	28·07	36·84	29·82	5·26	..	..
South-eastern Queensland	No.	316	71	123	98	22	2	..
	%	..	22·47	38·92	31·01	6·96	0·63	..
South Burnett	No.	97	20	51	21	5	..	..
	%	..	20·62	52·58	21·65	5·15	..	..
Central Burnett	No.	35	23	11	1	..	..	..
	%	..	65·71	31·43	2·86	..	..	..
Upper Burnett	No.	20	3	6	8	3	..	..
	%	..	15·00	30·00	40·00	15·00	..	..
Port Curtis	No.	31	24	7	..	..	..	..
	%	..	77·42	22·58	..	..	..	..
Mackay	No.	18	8	6	4	..	..	..
	%	..	44·44	33·33	22·22	..	..	..
Atherton Tableland ..	No.	71	11	16	23	15	6	..
	%	..	15·49	22·54	32·39	21·13	8·45	..
All Queensland, 1950–51 ..	No.	814	194	289	240	78	13	..
	%	..	23·83	35·50	29·48	9·58	1·60	..
All Queensland, 1949–50 ..	No.	715	75	305	267	60	8	..
	%	..	10·49	42·66	37·34	8·39	1·12	..
All Queensland, 1948–49 ..	No.	507	71	228	152	38	17	1
	%	..	14·00	45·00	30·00	7·50	3·30	0·20

Lactation Periods.

It has already been mentioned that only 24.8% of the cows milked for a full period of 270 days. The average production of these cows was 56% above the average production of other cows which completed lactations. The average length of completed lactations for the year 1950-51 was 203 days, in comparison with 223 and 220 days respectively for each of the previous two years. The average length of lactation for each age group in each district is given in Table 10.

TABLE 10.

AVERAGE LENGTH OF LACTATION FOR EACH AGE GROUP ACCORDING TO DISTRICTS.

District.	2 years.	3 years.	4 years.	Mature.	Unknown Ages.	All Ages.
	days.	days.	days.	days.	days.	days.
Eastern Downs ..	201	207	215	215	203	206
Western Downs ..	187	184	192	194	201	193
South-eastern Queensland	203	211	213	214	211	211
South Burnett ..	185	195	202	205	196	197
Central Burnett ..	167	153	154	165	119	147
Upper Burnett ..	190	193	213	210	185	194
Port Curtis	139	168	187	169	151	156
Mackay	196	215	219	215	140	184
Atherton Tableland..	209	230	233	228	214	221
All Queensland ..	196	203	208	209	200	203

The three herds which had the highest average herd production in the State during the 12 months are as follows:—

Mr. A. M. Lee, Goomburra (Eastern Downs) had 20 cows which completed lactations during the year for an average production of 5,728 lb. milk, 5.1% butterfat content, and 293 lb. butterfat, with an average lactation period of 270 days. Mr. Lee came to Queensland from Victoria about five years ago and has concentrated on building a good

Plate 185.

Portion of herd of Mr. A. M. Lee, Goomburra. Mr. Lee's herd was the highest producing herd for the 1950-51 herd recording year, with an average production of 5,728 lb. milk, 5.1% butterfat content, and 293 lb. butterfat.

Plate 186.

Portion of farm and herd of Mr. R. A. Griffiths, Moregatta, Atherton Tableland. This was the second-highest producing herd of the herd recording season of 1950-51, the average production being 6,554 lb. milk, 4.4% butterfat content, and 287 lb. butterfat.

Plate 187.

Mr. R. S. Griffiths' A.I.S. cow "Envy." This cow was the second-highest producing animal for the year 1950-51, with a production of 8,658 lb. milk, 5.7% butterfat content, and 500 lb. butterfat.

Jersey herd. He has been a keen supporter of herd recording and joined the Allora herd recording group when it was formed in May, 1948. The production for the previous two years was:—

	Cows.	Milk. lb.	Test. %	Butterfat. lb.	Days.
1948-49 ..	18	5,892	4.3	256	253
1949-50 ..	19	4,490	4.6	208	245

The second highest herd, owned by Mr. R. S. Griffiths, Moregatta (Atherton Tableland), is an old-established A.I.S. herd. The 52 cows averaged 6,554 lb. milk, 4.4% butterfat content, and 287 lb. butterfat. The average length of lactation was 254 days. This herd relies on pastures, a small amount of concentrates being fed to a few cows only. For the previous two years the average production was:—

	Cows.	Milk. lb.	Test. %	Butterfat. lb.	Days.
1948-49 ..	29	5,833	4.3	252	261
1949-50 ..	32	6,107	4.4	269	258

The third highest herd is owned by Mr. G. Stephens, Darlington, Beaudesert (South-eastern Queensland). This Jersey herd had 20 cows with completed lactations for an average production of 5,069 lb. milk, 5.3% butterfat content, 269 lb. butterfat, and an average length of lactation of 255 days. Mr. Stephens was a foundation member of the Beaudesert herd recording group, the first to be formed in Queensland. The previous years' average production figures were:—

	Cows.	Milk. lb.	Test. %	Butterfat. lb.	Days.
1948-49 ..	111	3,647	5.1	186	211
1949-50 ..	76	4,323	5.1	221	217

Mr. Stephens withdrew his herd from the scheme during the 1950-51 year and this accounts for the small number of cows which completed lactations in that year.

Report on Pure-bred Production Recording.

In previous years, the annual report on pure-bred production recording has been distributed in pamphlet form as a supplement to this journal. For reasons of economy, the report for the year ended 30th June last will appear as a series of articles in the journal. The first will be published in the January issue.

Readers whose subscriptions are about to expire, and who desire to have the complete series of production records, are advised to renew their subscriptions without delay.

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Acidity and Moisture Control During the Manufacture of Cheddar Cheese.

T. A. MORRIS, Division of Dairying.

THE development of acidity is the principal single factor responsible for the transformation of milk into cheese after the rennet is added. The lactic acid which the starter organisms produce from the milk sugar is responsible for the expulsion of whey and the conversion of the calcium paracaseinate of the curd into mono-calcium-paracaseinate; this and butterfat form the basic substances of cheese. The preservation of the cheese and the action of the enzyme in the rennet extract in converting the indigestible curd to readily digestible and nourishing cheese are dependent on this acidity. However, it is possible to develop too high an acidity, which, as well as spoiling the body of the cheese, will cause a sour or bitter flavour. Therefore, a correct rate of acid development must be obtained. Satisfactory control of acidity development is essential if cheese of consistently good quality is to be made.

The acidity of the milk when received has a strong influence on the rate at which acidity develops during cheesemaking and may often be responsible for the necessity to vary the manufacturing procedure.

However, the experienced cheesemaker has many means at his disposal for controlling the amount of acid developed in the cheese manufactured. Those measures which are applied during the manufacturing procedure are mainly aimed at reducing the moisture content of the curd, because there is a direct relationship between this and the extent of acid development. The lactose which is utilised by the lactic acid producing bacteria (the starter organisms) occurs in solution in the water content of milk. Thus the greater the amount of moisture retained by the curd, the greater is the potential acidity development. A curd with a low moisture content will develop acid at a slower rate and to a lower final degree than will curd with a high moisture content. However, the rate of expulsion of moisture is influenced considerably by the rate of the development of acidity. When acid development is slow, the rate of moisture expulsion is delayed, and the final moisture content of the cheese tends to be higher. Similarly, when acid production is too fast, there is slower expulsion of moisture after an initial period of about one hour after cutting. The final cheese will have a high moisture content unless corrective measures are applied.

Moisture, however, plays other important roles in influencing cheese quality. It considerably affects the body of the cheese, as well as being instrumental in making or marring cheese flavour. A cheese with a high percentage of moisture in the fat-free-substance will tend to have a weak, pasty body and will develop off-flavours much more rapidly than one with a normal percentage of moisture in the fat-free-substance. A low percentage of moisture in the fat-free-substance of cheese tends to cause a harsh, mealy body and retards the development of flavour. It is mainly on the mixture of moisture and fat-free-substance that flavour-producing bacteria act, and the relative wetness or dryness of this mixture influences their activity whether they are desirable or undesirable flavour-producing organisms. If milk quality is low, and the proportion of undesirable organisms gaining entry to the cheese is high, a cheese with a low moisture content should be

manufactured to retard the development of off-flavours. Such a cheese will mature more slowly but will ultimately develop a cleaner flavour than a similar cheese with a high moisture content.

The cheesemaker must therefore be able to control these two important factors—moisture and acidity—in such a manner that a satisfactory balance is attained.

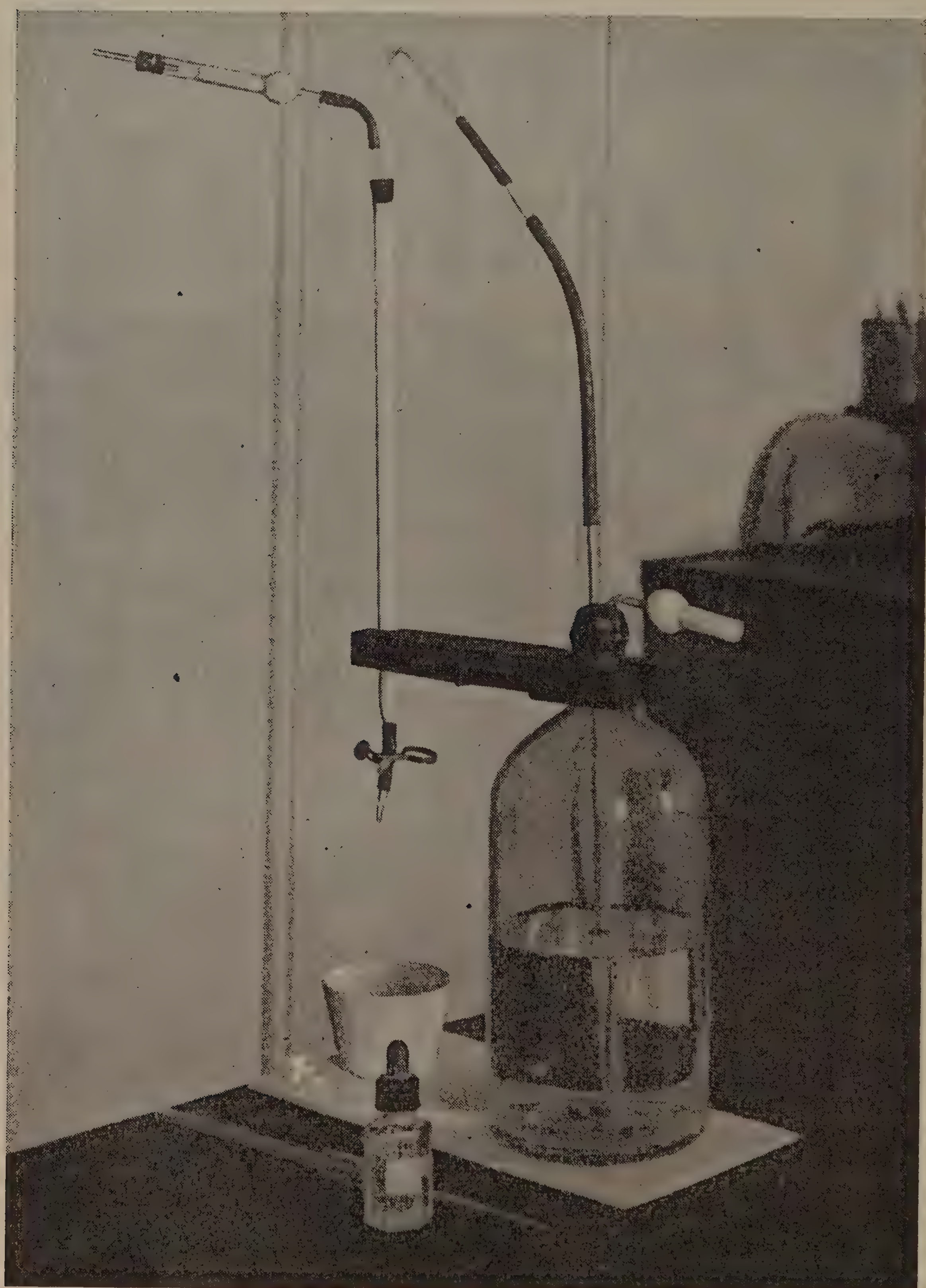


Plate 188.

Apparatus for Conducting the Acidity Test on Whey. Accurate acidity-testing is essential in controlling the development of acidity during cheesemaking.

In dealing with the control of acid development two instances must be considered:—

(1) Where corrective measures could be applied before the commencement of making, as a result of experience gained from the previous day's manufacture.

(2) Where manufacture has begun—for example, when the vat has been cut.

METHODS OF CONTROLLING ACIDITY AND MOISTURE CONTENT APPLICABLE BEFORE CUTTING THE CURD.

Variation of the Amount of Starter and the Length of the Priming Period.

The greatest change in the rate of acidity development may be effected by varying the quantity of starter used or the length of the priming period. The production of lactic acid is governed by the number of starter organisms present, their activity and the length of time they have had to multiply. Therefore, acid development is carried on at a faster rate during manufacture when a large quantity of starter is added than when a small quantity is used. A small quantity of starter allowed a long priming period has a similar effect to that of a large quantity of starter given a short priming period. The question therefore arises as to which of the factors under consideration—quantity of starter and length of prime—should be varied. If rapid acidity development is required and only the normal amount of starter is available, the priming period must be made longer. However, it is usually desirable to fix the length of the priming period at 10-15 minutes, which time is necessary for the starter organisms to recover from their dormant state. A short priming period not only saves time prior to setting but also reduces the danger of attack by bacteriophage. The starter is very open to attack by phage prior to the setting of the vat; thus the shorter the priming period, the less the possibility of a starter failure.

Variation of the Setting Temperature.

The ordinary starter streptococci have an optimum temperature of 70-75°F. Temperatures outside this range are less favourable for their growth, although a temperature of 90-95°F. may be reached before any significant falling off in activity occurs. Temperature is an important consideration in controlling the moisture content of the curd during manufacture, as the expulsion of moisture normally proceeds more rapidly at higher temperatures. Cheddar cheese vats are usually set at a temperature of 86-88°F. Vats set at a higher temperature tend to lose moisture at a faster rate in the early stages, but this rate slackens off later and the final moisture content of the cheese is normal. The higher temperature and the early loss of moisture may have a slight effect on the rate of acid development; however, the main feature is that by this means with an overripe vat of milk the rate of moisture expulsion may be brought more into line with the rate of acidity development. Thus an advantage can be gained in controlling a vat of milk which has a high initial acidity by setting it at a temperature of 6-8°F. higher than usual.

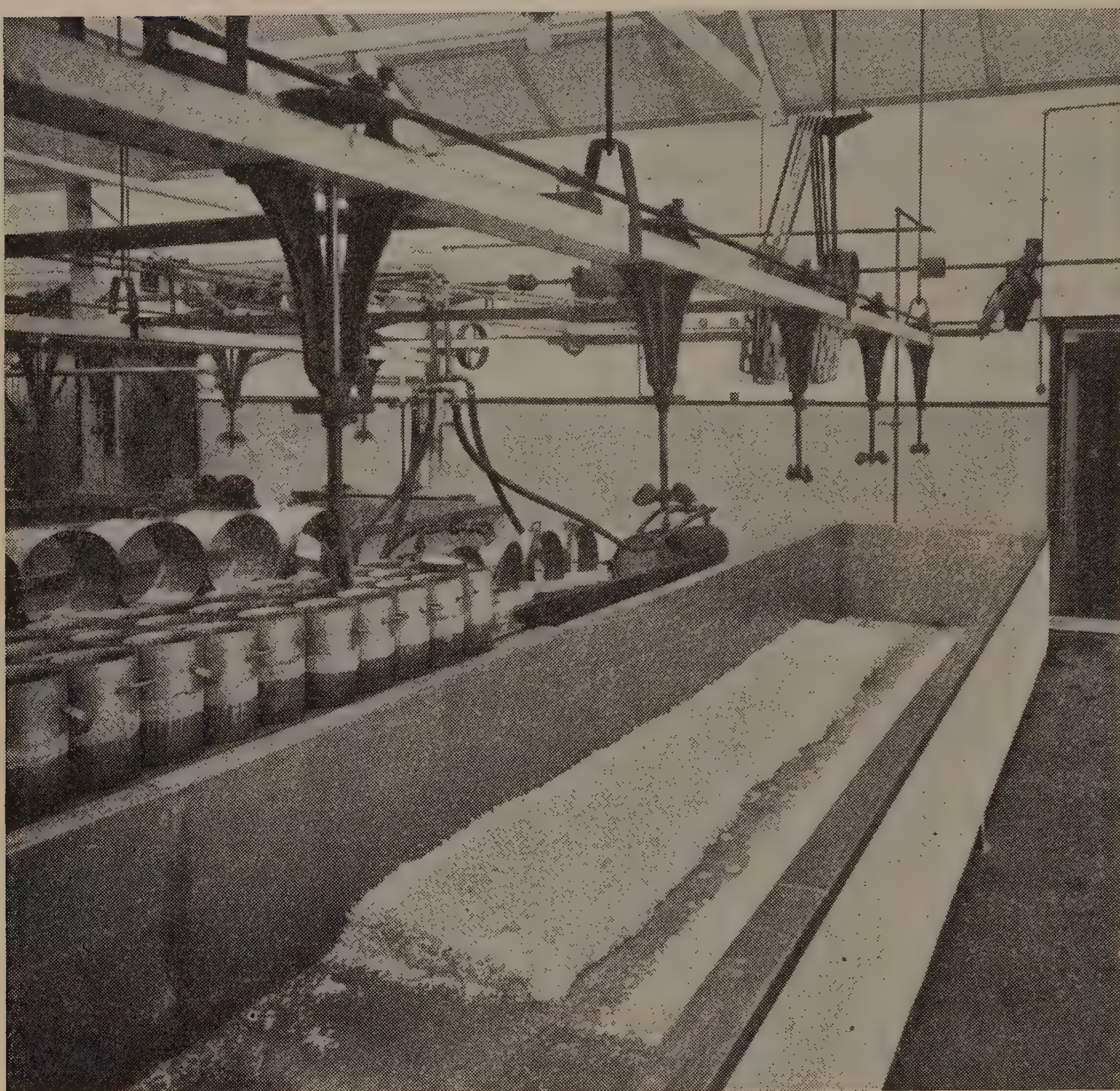


Plate 189.

The Draining of the Whey During Cheese Manufacture. The acidity at which the whey is run off is the main factor affecting the rate of acidity development after drying, and the final acidity of the cheese.

Variation of the Size of Cut.

When the curd is cut moisture escapes from the exposed surface. The finer the cut the greater is the surface of curd exposed and thus the escape of moisture is more rapid. This applies particularly during cooking, but less variation occurs in the moisture content in the later stages of manufacture. Many factories have two sets of curd knives: for example, one with spacings of three-eighths of an inch and one with quarter-inch spacings. The rate at which moisture is expelled after cutting may therefore be changed by varying the size of the curd knives. This is another method of keeping the rate of moisture expulsion in harmony with the rate of acid development, and, to some extent, a means of varying the final moisture content of the cheese.

METHODS OF CONTROLLING ACIDITY AND MOISTURE CONTENT AFTER CUTTING THE CURD.

Variation of the Cooking Temperature.

The usual range of temperature employed in cooking is 98-102°F. Below 98°F. insufficient firming of the curd takes place, while above 102°F. starter development is likely to be unduly retarded. If a vat is developing acidity at too fast a rate, a high cooking temperature will

aid in lessening the rate. Some starters are more sensitive than others to cooking temperatures in excess of 100°F. Within the temperature range of 98-102°F. the effect of variations in the cooking temperature on the moisture content of the curd is small. However, when a high cooking temperature is employed, acid production is slowed down with the result that the curd is cooked for a longer time, resulting in a lower moisture content. (On the other hand, a very high cooking temperature may reduce the rate of acid production in the later stages to such an extent that the expulsion of moisture becomes so slow that the final moisture content of the cheese is higher than normal).

Variation of the Running Acidity.

The running acidity is the main single factor influencing the rate of acidity development after drying, and the final acidity of the cheese. The lower the running acidity the slower is the subsequent rate of acid development and the lower is the final acidity attained. High running acidities cause a fast rate of acid development after drying and a high final acidity. Thus if a vat is making acid very fast, it should be run at a low acidity—any lack of firmness in the body of the curd as a result of the shortened cooking time should be corrected by dry-stirring. A vat which is producing acid slowly should be allowed to develop a higher acidity than usual before it is wheyed-off.

The effect of the running acidity on the moisture content of the cheese is indirect. Variations in the running acidity affect the subsequent rate of acid development, thus influencing the rate of moisture expulsion. A rate of acid development which is too slow or too fast retards the expulsion of moisture.

The running acidity is the key to the control of acid production from the wheying-off of the vat onwards. It is as important in ensuring the correct rate of acid production in the afternoon as the amount of starter is in the morning.

Variation of the Dry-Stirring of the Curd.

When a vat is wheyed-off an opportunity occurs for correcting the moisture content of the curd if it is too high. By dry-stirring the curd at this stage, the moisture content can be considerably reduced. This aids in controlling the acidity finally developed in the cheese, though it does not greatly alter the rate of acid production for the remainder of the manufacturing procedure. Where a "fast" vat occurs it should be thoroughly dry-stirred after wheying-off, particularly if the curd is moist. On the other hand, a "slow" vat should not be stirred at all. Moisture expulsion is slow unless acidity is developed in the curd. Thus in the case of a slowly working vat it is better to leave the curd moist, thereby encouraging acid production.

Variation of the Method of Cutting and Cheddaring the Curd.

Cutting the curd into large blocks, stacking the blocks, and allowing long intervals between turns aids in retaining moisture in the curd and encourages acid production. A fast-working vat of curd should be cut into small blocks, turned frequently, and not stacked.

Variation in the Time of Milling and in the Subsequent Treatment Prior to Salting.

When the curd is milled there is a temporary increase in the rate of expulsion of moisture. Early milling at a low acidity curtails acid production to some extent, while late milling at a high acidity is conducive to the attainment of a high acidity in the cheese. Early milling

may have a detrimental effect on the body and texture of the cheese, and in some cases a slightly fast vat may be more affected by early milling than it would be by a slight excess of acidity.

Curd which is developing acid normally but which is over-moist, and curd which is developing acid too rapidly, should be well stirred and drained after milling to allow the escape of whey. It is, however, more satisfactory if sufficient stirring has been given immediately after wheying-off to eliminate the need for more stirring, other than is necessary to keep the curd free.

Variation in the Time and Rate of Salting.

The addition of salt to the curd reduces the moisture content more or less in proportion to the amount of salt added. Thus a moist curd may be improved by the use of a little extra salt. The extent of acid production in the cheese subsequent to salting is doubly influenced by the amount of salt added. It is affected by the drying of the curd and also by the inhibitory effect which the salt (in the quantities used in cheesemaking) itself has on the acid-producing organisms. A "slow" vat should be salted later and with less salt than a normal or "fast" vat. It is more common for a vat to be salted too early than too late. Early salting of a normal or "slow" vat checks the breakdown of the curd before it has progressed to a satisfactory stage and may thus cause a harsh body in the cheese and delayed ripening. Because of the detrimental effect of excessive salt on the rate of ripening of the cheese and the development of flavour, it is not desirable to allow a fast, or moist, vat of curd to be brought to the salting stage before corrective measures are applied.

SUMMARY.

The acidity and the moisture content of cheese are so linked that when efforts to control one are made the possible effects on the other must be kept in mind.

The amount of starter used and the length of the priming period largely determine the rate of acidity development up to the time of wheying-off. Variation of the running acidity is the most effective means of controlling the later rate of acid development and the final acidity of the cheese.

The most effective means of reducing the moisture content of the cheese is by dry-stirring after wheying-off.

Slight daily variations in the rate of acid production may be dealt with as follows:—

(1) When acid production is too fast:—

- (*a*) Raise the cooking temperature.
- (*b*) Whey-off at a lower acidity.
- (*c*) Dry-stir the curd thoroughly after wheying-off.
- (*d*) Cheddar the curd in small blocks and turn frequently.
- (*e*) Do not stack the blocks.
- (*f*) Mill early.
- (*g*) Use a little extra salt.

(2) When acid production is too slow:—

(*a*) Lower the cooking temperature.

(*b*) Whey-off at a higher acidity.

(*c*) Do not dry-stir the curd.

(*d*) Cheddar the curd in large blocks which are stacked and allow long intervals between turns.

(*e*) Mill late.

(*f*) Allow a higher acidity to be reached before salting and use less salt—according to the moisture content of the curd.

Departmental Publications.

The following publications are among those available free of charge to Queensland primary producers on application to the Department of Agriculture and Stock, Brisbane.

Dairy Pamphlets.

No. 10.—Dairy Building and Equipment Competition, 1951.

No. 13.—Register of Merit for Dairy Cattle.

Standards Pamphlets.

No. 47.—Seed Testing Explained.

Plant Industry Advisory Leaflets.

No. 245.—Pulse Crops (Beans and Peas).

No. 246.—The Peach.

No. 247.—Linseed Growing in Queensland.

No. 248.—Nut Crops.

No. 249.—The Apricot.

No. 250.—The Plum.

No. 251.—Beekeeping Legislation.

No. 252.—The Grape Scale.

Animal Industry Advisory Leaflets.

No. 34.—Grass Tetany or Oat Tetany.

No. 40.—Botulism in Poultry.

No. 42.—Portable Calf Bails.

No. 43.—Sheath Rot (Posthitis) of Sheep.

No. 45.—Cheesy Gland or Caseous Lymphadenitis of Sheep.

No. 46.—Milk Fever (Hypocalcaemia) or Pregnancy Toxaemia of Ewes.

No. 47.—Pink Eye or Blight of Sheep.

No. 50.—The Problem of Brand Damage in Wool.

No. 51.—Leptospirosis in Cattle.

Animal Industry Pamphlets.

No. 13.—The Overfat Pig—Causes and Remedial Measures.

No. 17.—The Feeding of Pigs.

No. 18.—Selection and Breeding of Dairy Cattle.

No. 19.—Fertility and Infertility of Sheep.

Recent Books.

"Insects Affecting Livestock, with Special Reference to Important Species Occurring in Australia."

By F. H. S. Roberts.

This book has particular usefulness for the Queensland stock-owner and student inasmuch as it is written by a research worker who has been engaged in investigational work in this State for over 20 years.

Dr. Roberts has not confined himself to the true insects but has dealt in detail also with mites and ticks. Numerous species of economic importance are described and illustrated. Their effects on livestock are recorded in detail, and current control measures are described.

For the student there are, in addition, sections on the structure and classification of insects, mites, and ticks.

The book is available from booksellers for 45s.

"Sheep and Property Management."

By E. H. Pearse.

A mass of information on many aspects of sheep husbandry and property improvements in Australia is contained in the new edition of the book previously titled, ''Sheep, Farm, and Station Management.''

Particularly useful are the sections on yards, gates, sheds, and water supply, but there is valuable reference matter also in the many chapters dealing wtih breeding, flock management, diseases of sheep, destruction of pests, and so on.

The book is published by The Pastoral Review Pty Ltd., of Sydney and Melbourne, and is sold for 27s. 6d.

"Veterinary Therapeutics."

By Geo. F. Boddie.

This is not a handbook for the farmer desirous of diagnosing and treating the ailments of his stock, but a textbook on drugs and the principles of their use in veterinary medicine. As such, it is a useful reference book for the student. Many stock-owners, however, would find the book a useful addition to their libraries.

Our copy is from Macmillan and Co. Ltd., St. Martin's street, London. The English price is 15s.

ASTRONOMICAL DATA FOR QUEENSLAND.

JANUARY

Supplied by W. J. NEWELL, Hon. Secretary of the Astronomical Society of Queensland.

TIMES OF SUNRISE AND SUNSET.

At Brisbane.			MINUTES LATER THAN BRISBANE AT OTHER PLACES.					
Day.	Rise.	Set.	Place.	Rise.	Set.	Place.	Rise.	Set.
	a.m.	p.m.						
1	4.56	6.46	Cairns	48	9	Longreach	43	27
6	5.00	6.47	Charleville	29	25	Quilpie	33	37
11	5.04	6.47	Cloncurry	63	36	Rockhampton ..	18	2
16	5.08	6.47	Cunnamulla ..	28	31	Roma	19	15
21	5.12	6.46	Dirranbandi ..	16	22	Townsville	40	9
26	5.16	6.45	Emerald	27	12	Winton	51	30
31	5.20	6.43	Hughenden ..	48	22	Warwick	2	6

TIMES OF MOONRISE AND MOONSET.

At Brisbane.

Day.	Rise.	Set.
	p.m.	a.m.
1	7.42	5.26
2	8.19	6.23
3	8.52	7.19
4	9.23	8.13
5	9.51	9.06
6	10.18	9.57
7	10.46	10.48
8	11.16	11.41
		p.m.
9	11.49	12.36
10	..	1.34
	a.m.	
11	12.27	2.35
12	1.12	3.38
13	2.05	4.41
14	3.05	5.42
15	4.13	6.37
16	5.24	7.25
17	6.35	8.07
18	7.44	8.45
19	8.51	9.20
20	9.56	9.55
21	10.59	10.31
	p.m.	
22	12.02	11.09
23	1.06	11.50
24	2.08	..
		a.m.
25	3.08	12.36
26	4.04	1.26
27	4.55	2.21
28	5.39	3.18
29	6.19	4.15
30	6.53	5.11
31	7.24	6.06

MINUTES LATER THAN BRISBANE (SOUTHERN DISTRICTS).

Charleville 27; Cunnamulla 29; Dirranbandi 19; Quilpie 35; Roma 17; Warwick 4.

MINUTES LATER THAN BRISBANE (CENTRAL DISTRICTS).

Day.	Emerald.		Longreach.		Rockhampton.		Winton.	
	Rise.	Set.	Rise.	Set.	Rise.	Set.	Rise.	Set.
1	18	29	26	44	1	20	29	52
6	19	19	35	36	10	10	41	41
11	29	11	45	25	20	0	52	28
16	28	13	44	28	19	2	51	31
21	15	24	31	40	6	15	35	46
26	9	30	25	45	0	21	26	53
31	14	24	30	40	5	16	34	47

MINUTES LATER THAN BRISBANE (NORTHERN DISTRICTS).

Day.	Cairns.		Cloncurry.		Hughenden.		Townsville.	
	Rise.	Set.	Rise.	Set.	Rise.	Set.	Rise.	Set.
1	8	52	36	65	21	50	8	44
3	16	44	41	60	26	46	14	37
5	26	35	47	55	32	40	22	30
7	35	25	54	47	39	32	29	22
9	44	15	61	41	45	26	37	14
11	53	6	67	34	50	20	44	7
13	55	3	68	32	51	18	45	4
15	53	7	67	35	50	21	44	8
17	43	17	60	42	45	27	36	16
19	32	29	52	50	36	35	26	25
21	20	40	44	58	29	43	18	34
23	10	49	37	63	22	49	9	41
25	3	53	34	66	18	51	4	44
27	5	55	35	67	19	52	5	45
29	10	50	37	63	22	49	9	42
31	19	41	42	58	27	44	17	35

Phases of the Moon.—Last Quarter, January 8, 8.09 p.m.; New Moon, January 16, 12.08 a.m.; First Quarter, January 22, 3.43 p.m.; Full Moon, January 30, 9.44 a.m.

On December 15 the sun will rise and set 23 degrees south of true east and true west respectively, and on the 6th and 19th the moon will rise and set approximately at true east and true west respectively.

On January 30 there will be a total eclipse of the moon, but it will not be visible from Queensland.

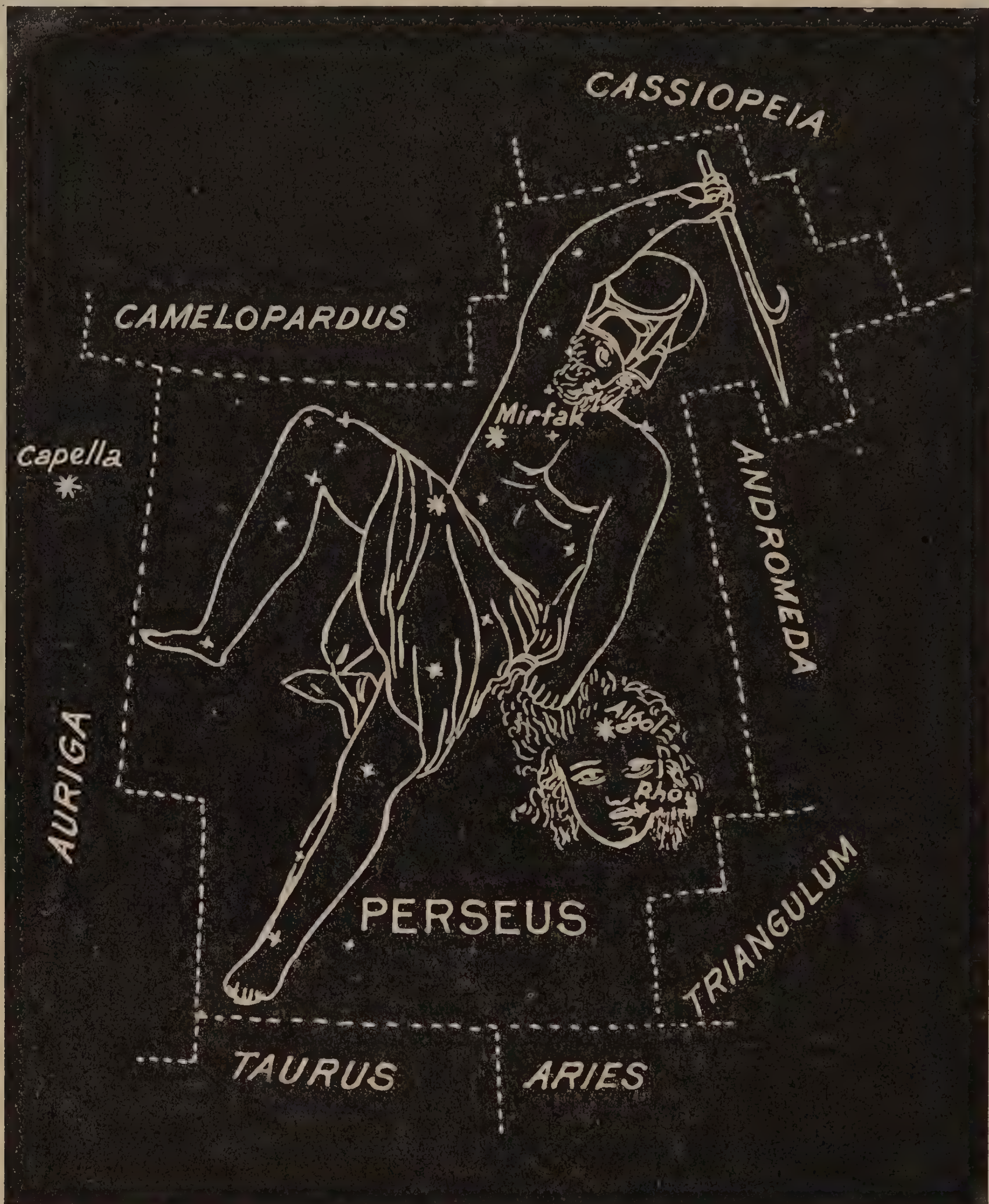
Mercury.—At the beginning of the month, in the constellation of Ophiuchus, will rise 1 hour 17 minutes before the sun, and at the end of the month, in the constellation of Capricornus, will rise 10 minutes before the sun.

Venus.—Still a very brilliant object in the western evening sky, reaching greatest angle east of the sun on the 21st. At the beginning of the month, in the constellation of Capricornus, will set 2¾ hours after the sun, and after passing Mars about the 18th will be placed in the constellation of Pisces at the end of the month, when it will set 2 hours 15 minutes after the sun.

Mars.—In the constellation of Aquarius at the beginning of January, will set between 9.45 p.m. and 11 p.m.; at the end of the month, in the constellation of Pisces, will set between 8.45 p.m. and 10 p.m.

Jupiter.—In the constellation of Aries, will set between 1.30 a.m. and 2.45 a.m. on the 1st and about midnight on the 31st.

Saturn.—Situated in the constellation of Virgo, will rise about midnight at the beginning of the month and between 10.31 p.m. and midnight at the end of the month.



THE CONSTELLATIONS.

PERSEUS.

Perseus is named for the hero who rescued Andromeda from the monster and vanquished the Medusa. It is a large group but lies well to the north and is more suitable for observation from the north of Queensland than from the south of the State. A line from the Belt of Orion through Aldebaran and produced to about its own length will bring the eye to the vicinity of Algol (Beta Persei), the prototype of the "Algolid" or "dark eclipsing" variables. Its arabic name, Algol, which means "The Demon," suggests that its variability was well known to the Arabs centuries ago. Its magnitude for about 59 hours is practically constant at 2.3, but with a slight secondary fall and rise of one-twentieth magnitude about halfway. It then decreases rapidly to magnitude 3.5 in about 5 hours and in the next 5 hours regains its former brightness. The total period is about 69 hours. The variation in light is due to two stars, one bright and the other faint, very close together, revolving about a common centre of gravity and mutually eclipsing each other. About 3 degrees south of Algol is Rho Persei, which is a good star with which to compare Algol's brightness. Algol is much brighter usually, but at minimum will be quite as faint as Rho. Mirfak (Alpha Persei) is a second magnitude star about 10 degrees north of Algol. Algol is near the meridian about 8 p.m. at the beginning of January; from Brisbane it is seen about 20 degrees above the northern horizon, but from Cairns and districts in that latitude it will be seen about 30 degrees above the horizon when on the meridian. The group does not contain a first magnitude star.

[*Supplement to the "Queensland Agricultural Journal," February,* 1952.]

QUEENSLAND
DEPARTMENT OF AGRICULTURE AND STOCK

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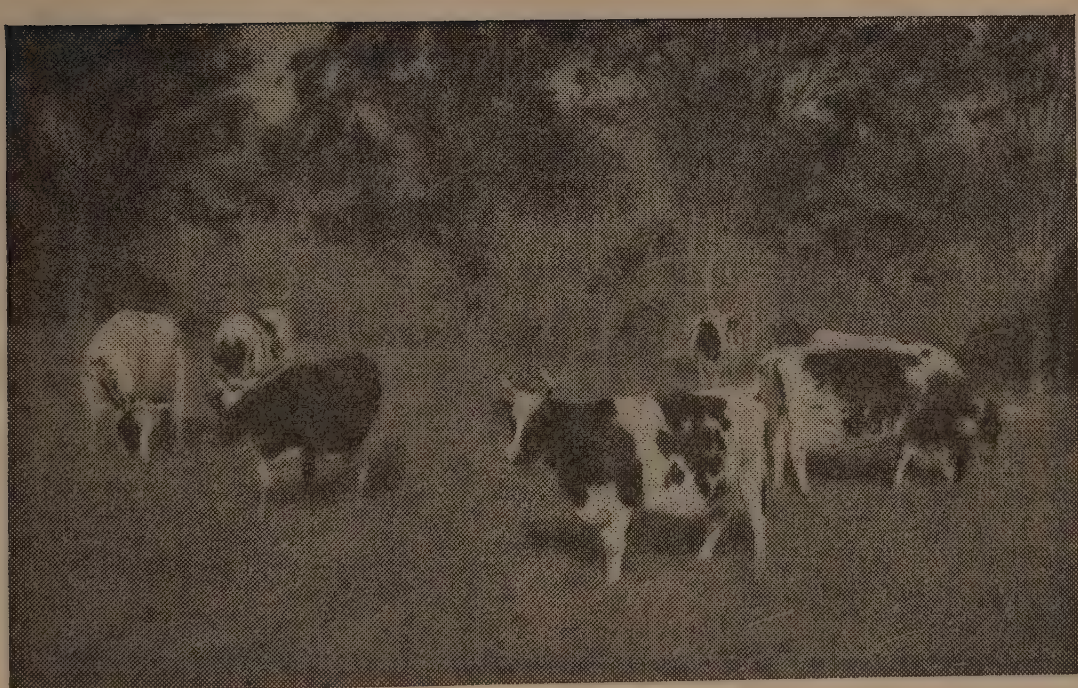
Pure-Bred Dairy Cattle Production Recording

Report for the year 1950-51

By S. E. PEGG, Q.D.A.
Senior Adviser (Herd Recording)
Division of Dairying



Issued by direction of
The Hon. H. H. COLLINS, M.L.A.
Minister for Agriculture and Stock

COVER PICTURE.

A group of Ayrshire cows owned by Mr. J. N. Scott, "Auchen Eden," Camp Mountain.

QUEENSLAND
DEPARTMENT OF AGRICULTURE AND STOCK

Pure-Bred Dairy Cattle Production Recording

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Minister for Agriculture and Stock

A. H. TUCKER, Government Printer, Brisbane.

FOREWORD

★ ★

The first full report of the performances of cows recorded under the Pure-Bred Production Recording Scheme was published for the year ending 30th June, 1950, and was favourably received by the dairying industry.

During the year much attention has been focussed on the low average production of dairy cows in this State and on the need for greater production of dairy produce to meet home and export requirements.

It is anticipated that the owners of pure-bred herds will play their part in an endeavour to increase dairy production by providing bulls for use in commercial herds, which will transmit greater production qualities to their offspring.

In order to provide useful information as to the prospective quality of the bulls, it is necessary to have production records of the female ancestors of the bull as well as progeny tests of the male ancestors, and it is hoped that more breeders will take advantage of the Pure-Bred Production Recording Scheme so that this information will be readily available.

H. H. COLLINS,
Minister for Agriculture and Stock.

Pure-Bred Dairy Cattle Production Recording, 1950-51.

Weather conditions were very good from July to December, 1950, but many districts had a wet period in January with little or no rain in the remaining months. This lack of rain prevented the planting of autumn and winter crops and had a very adverse effect on pasture growth. The result was a sudden drop in dairy production from April onwards, and this drop is reflected in the production figures of recorded cows.

During the year, 135 herds were submitted for recording, compared with 106 herds under the revised rules during 1949-50.

Table 1 shows the number of herds of the various breeds which have been recorded since 1947-48.

TABLE 1.

NUMBER OF HERDS RECORDED IN EACH BREED, 1947–48 TO 1950–51.

Breed.	1947–48.	1948–49.	1949–50.		1950–51.
			Old Rules only.	Revised Rules.	
A.I.S.	56	66	32	42	52
Ayrshire	3	8	2	6	9
Friesian	0	1	0	2	3
Guernsey	5	10	4	9	13
Jersey	60	64	24	46	57
Dairy Shorthorn	0	0	0	1	1
	124	149	62	106	135

The total number of cows submitted for recording during the year was 1,320, compared with 1,321 for the previous year, and of these 615 cows passed the required production standard, 538 failed and 167 were withdrawn. The particulars are given by breed in Table 2.

TABLE 2.

NUMBERS AND PERCENTAGES OF COWS COMPLETING LACTATIONS, 1949–50 AND 1950–51.

Breed.		Total.		Passed.		Failed.		Withdrawn.	
		1949-50.	1950-51.	1949-50.	1950-51.	1949-50.	1950-51.	1949-50.	1950-51.
A.I.S. ..	No.	611	471	278	196	165	221	168	54
	%	..	..	45·5	41·6	27·0	46·9	27·5	11·5
Ayrshire ..	No.	79	69	40	29	31	29	8	11
	%	..	..	50·6	42·0	39·2	42·0	10·1	15·9
Friesian ..	No.	8	26	2	9	4	9	2	8
	%	..	..	25·0	34·5	50·0	34·6	25·0	30·8
Guernsey ..	No.	101	129	66	64	23	47	12	18
	%	..	..	65·3	49·6	22·8	36·4	11·9	14·0
Jersey ..	No.	519	621	294	317	158	228	67	76
	%	..	..	56·6	51·0	30·4	36·7	12·9	12·2
Dairy Shorthorn ..	No.	3	4	0	0	3	4	0	0
	%	..	..	..	..	100	100	..	..
Total ..	No.	1,321	1,320	680	615	384	538	257	167
	%	..	..	51·5	46·6	29·1	40·8	19·4	12·6

Table 3 gives the numbers of cows which passed the production standard, failed to reach the standard, and were withdrawn from test in each year since 1942-43.

TABLE 3.

NUMBER OF COWS PASSING, FAILING, AND WITHDRAWN EACH YEAR SINCE 1942–43.

Year.	Passed.	Failed.	Withdrawn.	Total.
1942–43	249	60	..	..
1943–44	199	74	..	..
1944–45	278	112	60	450
1945–46	363	113	92	568
1946–47	366	80	262	708
1947–48	421	200	263	884
1948–49	759	305	363	1,427
1949–50	680	384	257	1,321
1950–51	615	538	167	1,320

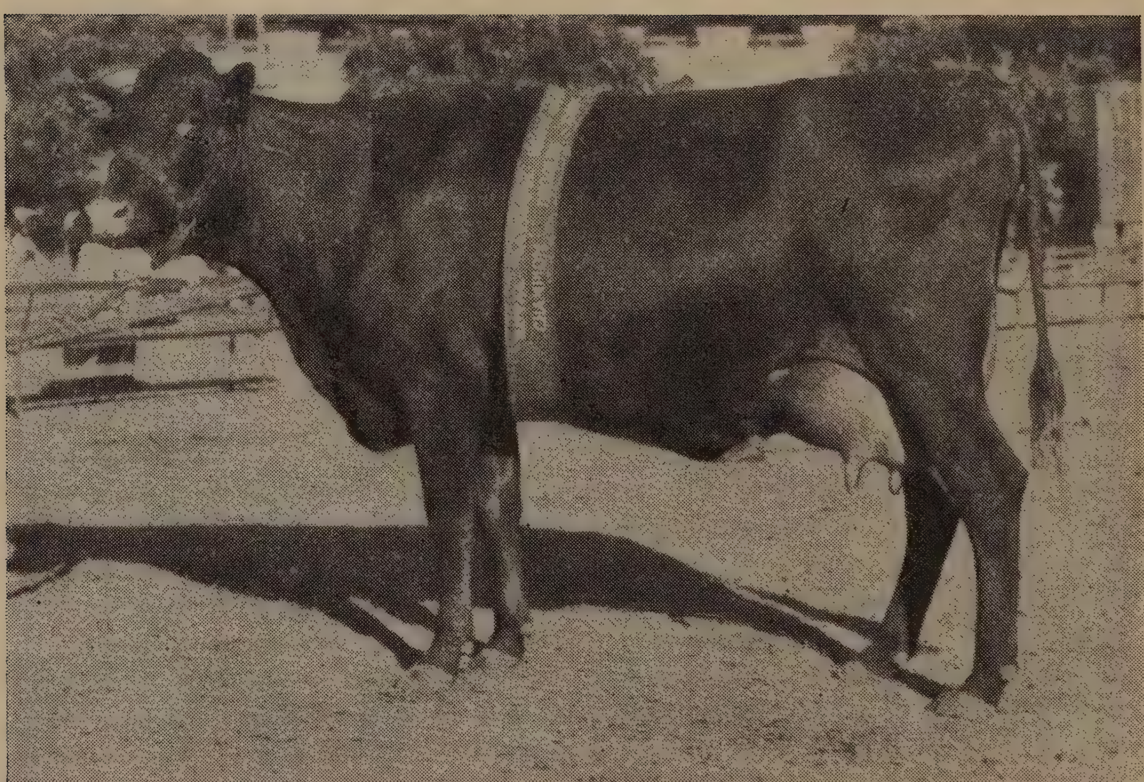

Plate 1

"Fairvale Laurel 2nd" owned by Mr. W. Henschell, "Yarranvale," Yarranlea. She produced 28,884 lb. milk and 1,062 lb. butterfat in a lactation period of 365 days. The average butterfat content of the milk was 3.6 per cent. This is the first cow to produce over 1,000 lb. of butterfat in Queensland.

The average production of all cows completing lactation during the year was 5,917 lb. milk and 271 lb. butterfat, representing an average test of 4·6 per cent. Table 4 gives the average production of cows completing lactation periods of 273 days or less for the years from 1946-47 to 1950-51.

TABLE 4.

AVERAGE PRODUCTION OF COWS COMPLETING LACTATION, 1946–47 TO 1949–50,

Year.	No. of Cows.	Average Production.		
		Milk.	Test.	Butterfat.
		Lb.	%	Lb.
1946–47	446	6,580	4·95	326
1947–48	621	6,981	4·67	326
1948–49	1,064	6,783	4·76	323
1949–50	1,064	6,608	4·69	310
1950–51	1,153	5,917	4·58	271

Table 5 gives the average production for the various age groups in each breed.

TABLE 5.

AVERAGE PRODUCTION IN AGE GROUPS OF COWS WHICH COMPLETED LACTATION RECORDS OF 273 DAYS OR LESS DURING THE YEAR ENDING 30TH JUNE, 1951.

Breed.	—	J.2.	S.2.	J.3.	S.3.	J.4.	S.4.	Mature.	All Ages.
A.I.S. ..	No. of Cows..	172	67	47	31	29	10	61	417
	Milk (lb.) ..	5,660	6,173	6,493	7,326	8,026	7,109	8,803	6,619
	Butterfat (lb.)	228	248	260	291	334	281	347	265
	Test (%) ..	4·0	4·0	4·0	4·0	4·2	4·0	3·9	4·0
Ayrshire	No. of Cows..	21	6	6	4	3	5	13	58
	Milk (lb.) ..	5,927	6,261	6,934	6,605	7,023	7,442	7,870	6,735
	Butterfat (lb.)	246	275	293	283	284	303	309	278
	Test (%) ..	4·2	4·4	4·2	4·3	4·0	4·1	3·9	4·1
Friesian ..	No. of Cows..	13	..	1	1	2	..	1	18
	Milk (lb.) ..	6,789	..	7,623	8,062	6,604	..	6,717	6,882
	Butterfat (lb.)	234	..	299	297	238	..	215	240
	Test (%) ..	3·4	..	3·9	3·7	3·6	..	3·2	3·5
Guernsey	No. of Cows ..	47	16	8	7	3	3	27	111
	Milk (lb.) ..	5,174	5,699	7,197	6,993	6,802	6,511	7,184	6,079
	Butterfat (lb.)	243	276	335	330	334	326	330	286
	Test (%) ..	4·7	4·8	4·7	4·7	4·9	5·0	4·6	4·7
Jersey ..	No. of Cows ..	239	59	37	33	34	27	116	545
	Milk (lb.) ..	4,704	5,173	5,092	6,047	6,024	5,701	5,864	5,241
	Butterfat (lb.)	244	272	277	322	317	309	306	275
	Test (%) ..	5·2	5·3	5·4	5·3	5·3	5·4	5·2	5·2
Dairy Shorthorn	No. of Cows ..	..	..	..	2	1	..	1	4
	Milk (lb.) ..	..	..	..	4,419	4,791	..	4,113	4,435
	Butterfat (lb.)	..	..	..	170	192	..	139	165
	Test (%) ..	..	..	..	3·8	4·0	..	3·4	3·7

All ages and all breeds—No. of cows 1,153 ; Milk, 5,917 lb. ; Butterfat 271 lb. ; Test 4·6%.

An Outstanding Production Record.

The outstanding production record of the year was that of the mature A.I.S. cow "Fairvale Laurel 2nd," owned by Mr. W. Henschell, Yarranlea.

This animal produced 23,094 lb. of milk and 853 lb. of butterfat (average test 3·6 per cent.) in 273 days and it was decided to continue her recording period for 365 days. In this period she produced 28,884 lb. of milk and 1,062 lb. butterfat. The average butterfat content was 3·6 per cent.

This is the first occasion in Queensland on which a cow has produced over 1,000 lb. of butterfat in a single lactation, and a new production record for 365 days was also established.

"Fairvale Laurel 2nd" was born on 5th June, 1943, and was bred by Mr. J. H. Anderson, "Fairvale," Inverary, Yandilla. Her sire was "Bingleigh Jean's Monarch" and her dam was "Fairvale Laurel."

"Bingleigh Jean's Monarch" has 10 recorded daughters and their average production is 8,874 lb. milk and 384 lb. butterfat, the average butterfat content being 4·33 per cent.

Table 6 shows the list of cows which have produced at least 820 lb. butterfat (equivalent to 1,000 lb. commercial butter) in a single lactation.

Tables 7 and 8 give the existing individual production records according to age groups of the different breeds of dairy cattle for lactation periods of 273 days and 365 days respectively.

Plate 2

"Trinity Daffodil's Effort," owned by Messrs. W. & C. E. Tudor, "Boree," Gayndah. This bull has 22 recorded daughters with 26 lactation records with an average butterfat production of 325 lb. The maturity equivalent was 425 lb. butterfat.

TABLE 6.

COWS WHICH HAVE PRODUCED BUTTERFAT EQUIVALENT TO 1,000 LB. COMMERCIAL BUTTER IN ONE LACTATION.

Name of Cow.	Owner.	Breed.	Date of Calving.	Age.	Days in Lactation.	Milk.	Test.	Butterfat.	Estimated Commercial Butter.
				Y. M.		Lb.	%	Lb.	Lb.
Fairvale Laurel 2nd ..	W. Henschell ..	A.I.S. ..	14–9–49	6 3	365	28,884	3·6	1,062	1,295
Charmer 2nd of City View ..	M. Lawrence ..	A.I.S. ..	1920	6 3	365	21,304	4·5	949	1,167
Gem May	W. Bishop	Jersey ..	11–10–46	9 9	365	15,065	6·1	924	1,127
Alfa Vale Model 4th ..	W. H. Thompson ..	A.I.S. ..	3–7–41	9 0	365	19,151	4·8	922	1,124
Alfa Vale Model 2nd ..	W. H. Thompson ..	A.I.S. ..	1–6–40	10 9	328	18,530	4·9	904	1,102
Evelyn of Sunnyview ..	J. Phillips	A.I.S. ..	18–8–33	6 11	273	22,575	4·0	904	1,102
Alfa Vale Nellie 4th ..	W. H. Thompson ..	A.I.S. ..	12–4–39	6 4	365	23,889	3·7	890	1,085
Alfa Vale Pansy	W. H. Thompson ..	A.I.S. ..	2–8–42	4 11	365	19,824	4·5	887	1,082
Alfa Vale Gem 4th	W. H. Thompson ..	A.I.S. ..	26–7–37	5 0	365	21,325	4·1	884	1,078
Alfa Vale Laura	W. H. Thompson ..	A.I.S. ..	4–7–39	5 8	365	23,158	3·7	858	1,046
Alfa Vale Model 4th ..	W. H. Thompson ..	A.I.S. ..	3–4–40	7 10	365	19,106	4·4	847	1,033
Alfa Vale Model 29th ..	W. H. Thompson ..	A.I.S. ..	8–5–48	3 5	349	17,635	4·8	847	1,033
Valera Sheila	Sullivan Bros. ..	A.I.S. ..	13–3–38	7 4	365	16,239	5·2	847	1,033
Penrhos Pansy	A. Sandilands ..	A.I.S. ..	25–5–35	7 3	273	17,603	4·7	844	1,029
Alfa Vale Model 3rd ..	W. H. Thompson ..	A.I.S. ..	12–8–36	6 1	365	18,734	4·4	835	1,018
College Princess Pontiac ..	Hickey and Sons ..	Friesian	3–5–32	7 10	365	24,027	3·4	830	1,012
Kilburnie Ethel 3rd ..	Macfarlane Bros. ..	A.I.S. ..	5–7–33	7 11	365	18,108	4·6	829	1,011
Blossom of Penrhos ..	A. Sandilands ..	A.I.S. ..	10–8–31	6 5	365	18,933	4·3	824	1,005

TABLE 7.

EXISTING PRODUCTION RECORDS FOR 273 DAYS FOR VARIOUS AGE GROUPS IN EACH BREED.

Age.	Cow.	Owner.	Year of Test.	Milk.	Test.	Butterfat.
		A.I.S.		Lb.	%	Lb.
J.2	Diana 17th of Kelston	A. Frank, Boonah	1930	13,604	4·20	572
S.2	Alfa Vale Model 16th	W. H. Thompson, Nanango	1942	12,783	5·00	640
J.3	Alfa Vale Model 29th	W. H. Thompson, Nanango	1949	14,516	4·07	691
S.3	Sunnyview Beauty 6th	J. Phillips, Wondai	1948	16,577	4·42	733
J.4	Alfa Vale Gentle 2nd	W. H. Thompson, Nanango	1936	15,186	4·57	695
S.4	Kyabram Mab	C. W. Black, Kumbia	1940	16,963	4·32	733
Mature	Sunnyview Evelyn	J. Phillips, Wondai	1933	22,575	4·00	904
		JERSEY.				
J.2	Inverlaw Phyllis	R. J. Crawford, Kingaroy	1940	9,756	5·57	544
S.2	Hamilton White Rose	J. Wilton, Killarney	1934	8,060	6·52	526
J.3	Lyndhurst Mollie	J. B. Keys, Gowrie	1931	11,828	4·83	571
S.3	Oxford Jezebel	E. Burton and Sons, Wanora	1941	10,950	5·88	644
J.4	Oxford Buttercup 4th	E. Burton and Sons, Wanora	1922	11,331	5·93	672
S.4	Trecarne Dairymaid	T. A. Petherick, Lockyer	1940	9,584	7·31	701
Mature	Brookland Cunning Drop	W. S. Conochie, Sherwood	1948	12,800	5·87	752
		GUERNSEY.				
J.2	Linwood Feather	A. S. Cooke, Maleny	1944	9,183	4·42	406
S.2	Springvale Verla	A. Ruge and Sons, Woowoonga	1950	8,517	5·3	455
J.3	Bangalow Vale Vanity Fair 3rd	W. A. K. Cooke, Maleny	1948	9,664	4·81	465
S.3	Linwood Sister	A. S. Cooke, Maleny	1944	8,992	5·02	452
J.4	Laureldale Vera	W. A. K. Cooke, Maleny	1945	9,599	4·96	476
S.4	Laureldale Vida	W. A. K. Cooke, Maleny	1946	10,313	4·82	498
Mature	Laureldale Vida	W. A. K. Cooke, Maleny	1948	12,473	4·51	563
		AYRSHIRE.				
J.2	Myola Gem 2nd	J. R. and R. M. Anderson, Yandilla	1937	12,578	3·74	472
S.2	Crescent Farm Monnie	N. J. Mann, Broxburn	1950	9,683	4·3	415
J.3	Myola Lady Tina	J. R. and R. M. Anderson, Yandilla	1937	8,126	4·77	388
S.3	Myola Jollity	J. R. and R. M. Anderson, Yandilla	1936	10,995	4·34	477
J.4	Crescent Farm Joyous	N. J. Mann, Broxburn	1950	10,848	3·8	411
S.4	Myola Lady Jean	J. R. and R. M. Anderson, Yandilla	1938	14,377	4·76	685
Mature	Fairview Vesta	J. R. and R. M. Anderson, Yandilla	1938	10,856	4·87	529
		FRIESIAN.				
J.2	Ryfield Dairymaid 8th	P. Falt, Cushine	1937	8,139	4·54	370
S.2	St. Athan's Bee	W. Newman, Wyreema	1930	14,143	3·12	442
J.3	St. Athan's Piebe Molly	F. C. Noller, Kumbia	1936	11,813	3·69	436
S.3	Brigalow Gem 2nd	A. O. Stumer, Boonah	1934	9,801	3·76	369
J.4	Tent Hill Princess	W. H. Grams, Gatton	1938	11,366	3·62	412
S.4	Stonybrae Belle	Hickey and Sons Pty. Ltd., Wilston	1930	11,156	3·69	412

TABLE 8.

EXISTING PRODUCTION RECORDS FOR 365 DAYS FOR VARIOUS AGE GROUPS IN EACH BREED.

Age.	Cow.	Owner.	Year of Test.	Milk.	Test.	Butterfat.
				Lb.	%	Lb.
		A.I.S.				
J.2	Diana 17th of Kelston	A. Frank, Boonah	1930	17,430	4·14	721
S.2	Alfa Vale Pansy	W. H. Thompson, Nanango	1940	16,237	4·59	746
J.3	Greyleigh Gem 139th	W. H. Thompson, Nanango	1943	16,825	4·46	751
S.3	Alfa Vale Gem 7th	W. H. Thompson, Nanango	1940	14,649	4·92	721
J.4	Alfa Vale Gentle 2nd	W. H. Thompson, Nanango	1936	17,369	4·71	818
S.4	Alfa Vale Pansy	W. H. Thompson, Nanango	1942	19,824	4·47	887
Mature	Fairvale Laurel 2nd	W. Henschell, Yarranlea	1951	28,884	3·6	1,062
		JERSEY.				
J.2	Inverlaw Phyllis	R. J. Crawford, Kingaroy	1940	12,472	5·85	730
S.2	Hamilton White Rose	J. Wilton, Killarney	1934	9,812	6·66	654
J.3	Lynhurst Marella	J. B. Keys, Gowrie	1932	11,225	5·44	611
S.3	Lavender of Calton	E. Burton and Sons, Wanora	1933	15,249	5·07	773
J.4	Does not exceed the record for 273 days					
S.4	Does not exceed the record for 273 days					
Mature	Gem May	W. Bishop, Kenmore	1947	15,065	6·13	924
		GUERNSEY.				
J.3	Laureldale Pamela	W. A. K. Cooke, Maleny	1948	11,698	4·86	569
		AYRSHIRE.				
		No records for 365 days.				
		FRIESIAN.				
S.2	St. Athan's Bee	W. Newman, Wyreema	1930	18,008	3·13	564
Mature	College Princess Pontiac	Hickey and Sons Pty. Ltd., Wilston	1932	24,027	3·45	830

Plate 3

"Tecoma Golden Darling" owned by Mr. A. L. Semgreen, "Tecoma," Coolabunia. This cow was the highest producing Jersey for the year 1950-51. She produced 10,464 lb. milk and 601 lb. butterfat with an average butterfat test of 5.7 per cent. in 273 days.

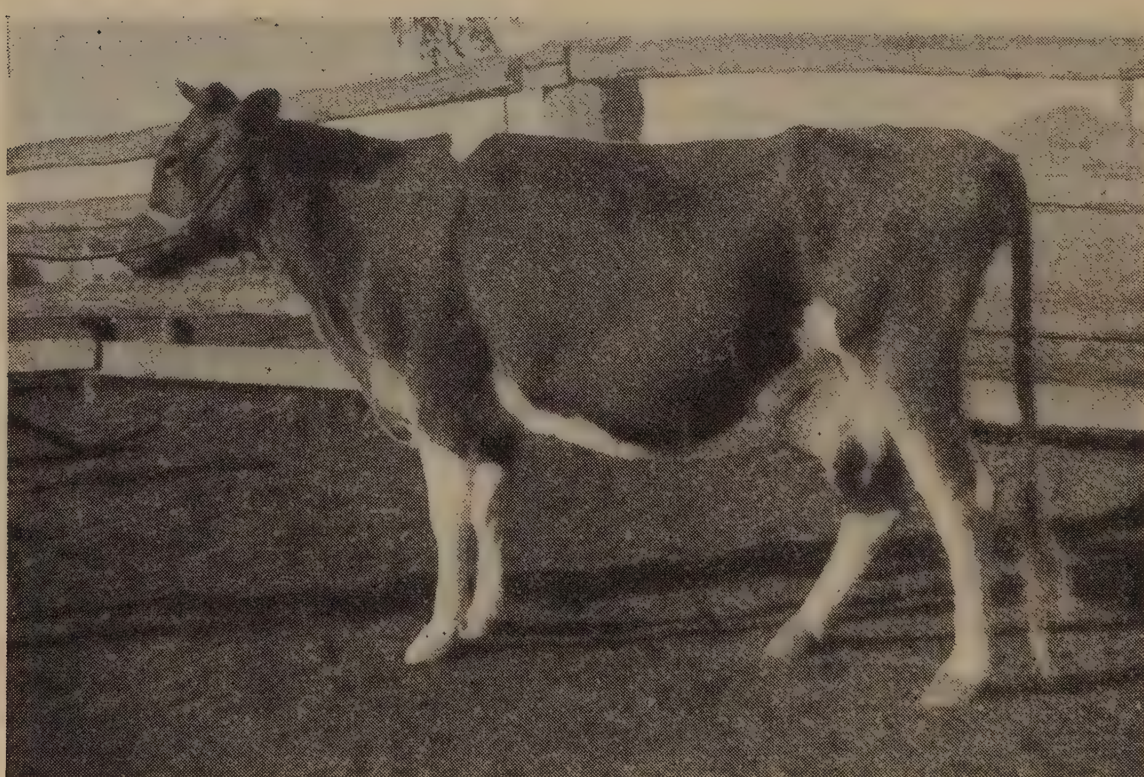

Plate 4

"Springvale Verla" (owned by Messrs. A. Ruge & Sons, "Springvale," Woowoonga) was the highest producing senior 2-year-old of any breed in 1950-51. She produced 8,517 lb. milk of 5.3 per cent. test, and 455 lb. butterfat. This creates a new State record for a senior 2-year-old for the Guernsey breed.

The 1950-51 season leaders for each age group in each breed are given in Table 9.

TABLE 9.

CLASS LEADERS IN EACH AGE GROUP FOR BUTTERFAT PRODUCED IN 273 DAYS.

Age Class.	Cow.	Milk. Lb.	Test. %	Butterfat. Lb.
	A.I.S.			
Mature	Bileena Bonnie 6th	14,535	3·9	578
S.4	Blanchview Dawn	9,765	4·1	403
J.4	Bantry Lila	10,868	4·4	481
S.3	Eachamvale Daphne 2nd	11,265	4·1	464
J.3	Navillus Gem 3rd	11,320	4·2	482
S.2	St. Andrews Olive	10,287	4·2	430
J.2	Valera Jean	8,651	4·5	389
	AYRSHIRE.			
Mature	Eleresley Jonquil	10,946	4·6	508
S.4	Auchen Eden Griselda	8,760	4·1	362
J.4	Holm Park Bonnie Myrtle 2nd	7,594	4·5	343
S.3	Auchen Eden Madelyn	8,252	4·5	376
J.3	Auchen Eden Pamela	7,864	4·7	376
S.2	Eleresley Buttercup	7,627	4·2	323
J.2	Auchen Eden Berenice	7,647	4·4	340
	FRIESIAN.			
S.3	Burnbrae Segis Sylvia	8,062	3·7	297
J.3	Brigalow Dazzler 23rd	7,623	3·9	299
J.2	Rockview Jessica	7,422	4·0	296
	GUERNSEY.			
Mature	Laureldale Vida	10,447	4·8	508
S.4	Fernhill Sunshade	7,661	5·3	409
J.4	Fernhill Honesty	6,563	4·9	322
S.3	Brookland Leah	6,287	5·1	320
J.3	Willowbrae Daffodil	7,956	5·0	399
S.2	Springvale Verla	8,517	5·3	455
J.2	Willowbrae Ruby	6,864	4·9	341
	JERSEY.			
Mature	Tecoma Golden Darling	10,464	5·7	601
S.4	Boree Effort's Pandora	9,516	5·0	483
J.4	Trecarne Jersey Queen 9th	7,976	6·2	491
S.3	Nairfale Noble's Esteem	8,032	6·0	480
J.3	Weelu Hardship's Effort	7,056	6·4	452
S.2	Windsor Royal Ruth	7,335	5·6	414
J.2	Boree Cute Complete	7,872	5·1	405

Withdrawals from Recording.

During the year permission was granted to withdraw 167 cows from test. The number and percentage of cows withdrawn for various reasons is given according to breed in Table 10.

TABLE 10.

CAUSES FOR WITHDRAWAL FROM RECORDING AND NUMBER OF COWS WITHDRAWN ACCORDING TO BREED AND CAUSE.

—	A.I.S.	Ayrshire.	Friesian.	Guernsey.	Jersey.	All Breeds.	Percentage of Withdrawals.
Mastitis	4	1	..	2	13	20	12·0
Footrot	2	..	..	6	1	9	5·4
Sickness	4	1	1	2	4	12	7·2
Herd withdrawn..	20	..	7	..	31	58	34·7
Sold	14	5	..	4	14	37	22·1
Died	1	..	..	..	4	5	3·0
Culled	3	1	..	..	3	7	4·2
Other Causes ..	6	3	..	4	6	19	11·4
Totals ..	54	11	8	18	76	167	..

Short Lactation Periods.

During the year 187 cows (16·2 per cent. of cows which completed their lactation) had a lactation period of less than 273 days.

A Survey of Herd Recording Data, particulars of which were published in the Queensland Agricultural Journal in September, 1950, showed the relationship between the length of lactation and the production of the animal, and indicates the necessity for cows to milk for a full lactation period if high yields are to be obtained.

As most cows recorded under the Pure Bred Production Recording Scheme are fed to a reasonable standard of nutrition, it would appear that inability to milk for 273 days may be hereditary, and if this is so, it behoves breeders to concentrate on strains which will milk the full period. Commercial dairy farmers need to give this aspect serious consideration when selecting future herd sires.

Table 11 shows the numbers and percentage of each breed which milked for lactation periods of less than 273 days.

TABLE 11.

NUMBER AND PERCENTAGE OF COWS IN AGE GROUPS AND BREEDS COMPLETING LACTATION PERIODS OF LESS THAN 273 DAYS.

Breed.		J.2.	S.2.	J.3.	S.3.	J.4.	S.4.	Mature.	Total.
A.I.S. ..	No.	31	18	20	14	8	4	12	107
	%	18·0	26·9	42·5	45·1	27·6	40·0	19·7	25·7
Ayrshire ..	No.	1	1	..	..	1	1	2	6
	%	4·8	16·6	..	..	33·3	20·0	15·4	10·34
Friesian ..	No.	..	..	..	..	..	..	..	..
	%	..	..	..	..	..	..	..	..
Guernsey ..	No.	6	3	1	..	..	2	4	16
	%	12·8	18·7	12·5	..	..	66·6	14·8	14·41
Jersey ..	No.	21	9	8	1	2	2	11	54
	%	8·8	15·2	21·6	3·0	5·9	7·4	9·5	9·91
Dairy	No.	..	..	..	2	1	..	1	4
Shorthorn	%	..	..	..	100	100	..	100	100
All Breeds..	No.	69	31	29	17	12	9	30	187
	%	14·0	20·9	29·2	21·8	16·0	20·0	13·7	16·2

Records of all cows which completed lactations during the year ended 30th June, 1951, are given in Table 12. Herds are grouped according to breed and the animals are listed under their owner's name. In the list of animals recorded by each owner, the names of cows have been grouped according to the sires. This should render it easier to follow the progeny of the various sires.

Plate 5

"Eleresley Jonquil" (owned by Stimpsons Ltd. "Eleresley," Loganlea) was the highest producing Ayrshire cow in 1950-51. Her production was 10,946 lb. milk and 508 lb. butterfat. The average butterfat test was 4.6 per cent.

A Preliminary Survey of Sires.

The information supplied on this subject in the 1949-50 report is continued in this issue (Table 13, page 54). All bulls included previously are again included, together with other bulls who now have 10 recorded daughters. Where more records were available for daughters of bulls listed last year, the average production figures have been amended accordingly.

It is considered that the information supplied gives a good indication of the productive qualities transmitted by the bull to his progeny, but it must be stressed that *when examining production records, it is essential to consider the conditions under which the records are made.* Probably the most reliable information is provided by the average of the two-year-olds, as these represent unselected daughters more than any other age group.

In order to supply a better means of comparison between the various sires, the average production of all recorded daughters is given together with the average "Maturity Equivalent" butterfat production.

It should be realised that the use of "Maturity Equivalent" factors will favour early maturing stock and will penalise late maturing stock, but at present it offers the only means of comparing productions at various ages.

Maturity Equivalent Factors.—For some time it has been felt that factors should be obtained for use in this State, as the only ones available were of unknown origin. These factors varied according to the age of the cow month by month and there was no proof of their accuracy under Queensland conditions.

During the year factors applicable to this State were obtained from all available records since 1930. In compiling this information, it was decided to give one factor for each age group—that is, 2-year-olds, 3-year-olds, and 4-year-olds. Factors were compiled for the A.I.S. and Jersey breeds, but even with these the data were limited. However, these factors have been used in determining the "Maturity Equivalent" butterfat production of the daughters of bulls listed in this report, but the factors will be revised from time to time as more data become available. Unfortunately there were insufficient data to obtain factors for the Ayrshire, Friesian and Guernsey breeds. The factors used are as follows:—

	A.I.S.	Jersey.
2 year olds	1·40	1·35
3 year olds	1·20	1·15
4 year olds	1·10	1·05

Plate 6

"Bileena Bonnie 6th" (owned by Messrs. Hart Bros., Clifton) was the highest producing A.I.S. cow for a 273 day period in 1950-51. She produced 14,535 lb. milk and 578 lb. butterfat. The average test was 3.9 per cent. butterfat.

TABLE 12.

Records of Cows Completing Lactation Records During the Year Ended 30th June, 1951.

Explanation of Table.

Owners are listed alphabetically within each breed.

Cows milked three times a day during some period of their lactations are indicated by an asterisk (*).

In brackets after the owner's name are shown the breed and the number of cows whose production records are given.

The butterfat production required for entry to the Advanced Register varies according to the age, and is as follows:—

Junior 2 year old (under $2\frac{1}{2}$ years at calving)	230 lb. butterfat
Senior 2 year old (between $2\frac{1}{2}$ and 3 years at calving)	250 lb. butterfat
Junior 3 year old (between 3 and $3\frac{1}{2}$ years at calving)	270 lb. butterfat
Senior 3 year old (between $3\frac{1}{2}$ and 4 years at calving)	290 lb. butterfat
Junior 4 year old (between 4 and $4\frac{1}{2}$ years at calving)	310 lb. butterfat
Senior 4 year old (between $4\frac{1}{2}$ and 5 years at calving)	330 lb. butterfat
Mature (5 years or over at calving)	350 lb. butterfat

Cow.	Sire.	Age.	Days Recorded.	Production. Milk.	Production. Test.	Production. Butterfat.
				Lb.	%	Lb.
AUSTRALIAN ILLAWARRA SHORTHORN.						
BEST, H. B. and K. A., Nangwee (A.I.S., 2).						
Yarranvale Gentle Lady	Rocklea Comet	J.4	210	4,463	4·0	180
Yarranvale Crescent	Fairvale Jellicoe	J.2	240	4,845	5·0	246
BRAFORD, A., Yangan (A.I.S., 9).						
Kanangra Sadie	Ashstead Royal Major	J.4	273	7,182	3·5	255
Kanangra Melba 2nd	Bileena Venture	S.3	240	5,643	4·0	226
Kanangra Duchess	Bileena Venture	J.3	273	5,437	4·2	230
Kanangra Pansy	Bileena Venture	S.2	240	5,603	4·1	230
Kanangra Lady Myrtle	Bileena Venture	S.2.	273	6,193	3·8	237
Kanangra Fairy	Bileena Venture	J.2	273	5,110	3·9	199
Bileena Rose 9th	Bileena Sunrise	S.2	273	5,766	3·9	225
Wenlock Fairy 2nd	Parkview Limerick	J.3	210	5,334	4·1	221
Wenlock Fairy 2nd	Parkview Limerick	J.2	273	5,616	3·7	212
COONAN, J., Cambooya (A.I.S., 2).						
Brundah Fay 3rd	Greyleigh Eros	Mature	273	11,611	3·4	403
Ennismore Nanette 2nd	Arolla Limerick	J.2	273	5,625	4·7	266

TABLE 12—*continued.*

RECORDS OF COWS COMPLETING LACTATION RECORDS DURING THE YEAR ENDED 30TH JUNE, 1951—*continued.*

Cow.	Sire.	Age.	Days Recorded.	Production. Milk.	Test.	Butterfat.
				Lb.	%	Lb.
CROOKEY, J., Allora (A.I.S., 3).						
Tabbagong Pet 4th	Parkview Ensign	Mature	273	10,574	3·8	405
Arolla Ruth 2nd	Bingleigh Premier	J.4	240	8,109	5·0	402
Arolla Velvet 6th	Bingleigh Premier	J.3	240	5,208	4·7	244
ENGLISH, J. K., Malanda (A.I.S., 5).						
Eachamvale Daphne 2nd	Blacklands Sperry	S.3	273	11,265	4·1	464
Eachamvale Beauty 2nd	Blacklands Sperry	S.3	273	9,524	4·1	387
Eachamvale Envy	Blacklands Sperry	J.3	150	3,786	3·4	129
Eachamvale Cella 4th	Blackalnds Sperry	J.2	273	5,874	4·8	281
Eachamvale Beauty	Cedargrove Commodore 2nd	Mature	273	13,264	4·0	526
EVANS, J. F., Malanda (A.I.S., 23).						
Evansvale Ethel	Evansvale Malanda	Mature	273	7,515	3·7	284
Evansvale President's Grace	Kyndalyn President	Mature	273	9,230	4·3	404
Evansvale Fairy Bell 2nd	Penrhos Bounty	J.2	273	6,644	4·2	283
Evansvale Tulip 3rd	Penrhos Bounty	J.2	273	6,039	4·1	252
Beechwood Mignonette 60th	Rosemount Cherry's Prince	J.4	273	6,776	4·3	297
Evansvale Pride 3rd	Sunnyview Spearvale	J.4	273	7,978	5·0	404
Evansvale Rosetta 9th	Sunnyview Spearvale	J.4	273	10,146	3·6	373
Evansvale Little Princess 3rd	Sunnyview Spearvale	J.4	273	8,217	4·2	351
Evansvale Ethel 2nd	Sunnyview Spearvale	S.3	273	10,669	3·5	383
Evansvale Pretty	Sunnyview Spearvale	S.3	273	10,061	3·4	248
Evansvale Rosetta 11th	Sunnyview Spearvale	S.3	273	7,398	4·2	317
Evansvale Evelyn 2nd	Sunnyview Spearvale	S.3	273	8,181	3·6	301
Evansvale Floss 5th	Sunnyview Spearvale	J.3	273	9,404	3·7	357
Evansvale Carey 4th	Sunnyview Spearvale	J.3	273	8,740	3·8	338
Evansvale Flower 5th	Sunnyview Spearvale	J.3	240	6,872	4·5	313
Evansvale Little Princess	Sunnyview Spearvale	S.2	273	7,929	4·0	318
Evansvale Olive 12th	Sunnyview Spearvale	S.2	273	7,160	4·0	290

Evansvale Modesty	Sunnyview Spearvale	S.2	273	6,582	3·8	253
Evansvale Little Princess 2nd	Sunnyview Spearvale	J.2	273	8,659	3·9	334
Evansvale Topsy	Sunnyview Spearvale	J.2	273	8,083	3·7	307
Evansvale Roan Pride 3rd	Sunnyview Spearvale	J.2	273	7,208	3·9	287
Evansvale Bluebell 2nd	Sunnyview Spearvale	J.2	273	6,185	4·6	285
Evansvale Thelma 2nd	Sunnyview Spearvale	J.2	273	7,355	3·4	254
EVANS, E. G., Maleny (A.I.S., 2).						
Arley Mermaid 24th	Arley Czar's Hero	J.3	273	10,009	4·2	419
Arley Mermaid 24th	Arley Czar's Hero	J.3	305	10,768	4·2	452
Arley Mermaid 24th	Arley Czar's Hero	J.3	365	11,858	4·2	502
Lauraven Buttercup	Arley Stateman 32nd	S.2	273	5,987	4·2	251
EZZY, A. F., Mt. Emlyn (A.I.S., 13).						
Jamberoo Winnie 13th	Murray Bridge Florrie's Prince	Mature	180	3,651	4·3	156
Nullabowry Olive 2nd	Nullabowry August	J.2	273	4,939	3·6	179
Nullabowry Norma 3rd	Parkview Limerick	J.4	240	7,851	3·9	303
Navillus Norma 3rd	Parkview Limerick	S.3	273	6,739	3·8	258
Nullabowry Rose 2nd	Jamberoo Banner	S.2	273	5,885	4·1	244
Nullabowry Gentle 2nd	Jamberoo Banner	S.2	240	5,754	4·0	232
Nullabowry Princess 4th	Jamberoo Banner	S.2	273	4,898	4·3	211
Nullabowry Dainty 2nd	Jamberoo Banner	J.2	273	6,538	4·5	296
Nullabowry Charm	Jamberoo Banner	J.2	273	7,245	4·0	294
Nullabowry Winnie	Jamberoo Banner	J.2	273	5,429	4·1	226
Nullabowry Gentle 2nd	Jamberoo Banner	J.2	273	5,331	4·1	223
Nullabowry Gladys 2nd	Jamberoo Banner	J.2	273	5,015	3·7	190
Nullabowry Dahlia	Jamberoo Banner	J.2	273	3,713	4·3	160
FLESSER, W., Boyland (A.I.S., 5).						
Roshill Dahlia 13th	Dnalwon Felex	S.3	210	5,604	3·5	197
Roshill Betty 10th	Dnalwon Felix	J.3	273	6,757	3·8	256
Roshill Felix Queenie	Dnalwon Felix	J.2	273	5,648	3·5	198
Roshill Almond 14th	Dnalwon King Lear	J.2	273	5,663	3·3	188
Roshill Queenie 18th	Dnalwon King Lear	J.2	273	5,568	3·2	179

TABLE 12—*continued.*

RECORDS OF COWS COMPLETING LACTATION RECORDS DURING THE YEAR ENDED 30TH JUNE, 1951—*continued.*

Cow.	Sire.	Age.	Days Recorded.	Production. Milk.	Production. Test.	Production. Butterfat.
				Lb.	%	Lb.
	FOGG, J. H., Toogoolawah (A.I.S., 6).					
Fernbank Hazel	Sunnyview Marshon	Mature	273	7,089	3·6	257
Fernbank Sacharine	Ventnor Eros	S.2	273	6,072	3·8	234
Ventnor Marie 28th	Berry Carson	J.2	273	8,218	3·9	322
Cedar Valley Red Queen	Kyabram Masterpiece	J.2	273	6,275	4·0	257
Aynesley Jane 16th	Haroldae Dandy	J.2	273	5,375	4·2	226
Bingleigh Prince's Molly	Trevlac Gentle's Prince	J.2	180	4,437	4·0	176
	FOWLER, T. W., Pittsworth (A.I.S., 13).					
Trevor Hill Oriole 2nd	Fairvale Jellicoe	S.3	273	8,109	5·0	403
Trevor Hill Locket	Fairvale Jeweller	J.2	273	5,151	4·1	211
Kenstan Melba	Reservoir Yenda	J.2	273	5,841	4·3	249
Kenstan Gem 3rd	Alfa Vale Mindful	J.2	273	7,849	4·6	359
Kenstan Judy	Alfa Vale Mindful	J.2	273	7,205	4·3	313
Kenstan Rose	Fairvale Janitor	S.2	273	6,022	3·6	215
Kenstan Dainty	Fairvale Janitor	J.2	273	6,654	4·1	274
Kenstan Rose	Fairvale Janitor	J.2	273	5,396	3·7	205
Kenstan Opal 3rd	Fairvale Janitor	J.2	120	2,250	4·0	92
Kenston Nellie	Trevor Hill Gallant	J.3	273	8,433	3·9	334
Kenstan Gem 2nd	Trevor Hill Gallant	J.2	273	5,393	4·0	220
Kenstan Tot	Trevor Hill Gallant	J.2	273	6,427	3·2	212
Kenstan Opal 2nd	Trevor Hill Gallant	J.2	273	5,403	3·8	210
	GRIFFITHS, R. S., Moregatta (A.I.S., 7).					
Fernhome Dainty	Merravale Gentle's Commodore	S.2	273	8,187	3·9	320
Roshill Duchess 14th	Roshill Monty	J.2	273	4,955	4·0	200
Fernhome Envy	Glengarry Gem's Royal	Mature	273	8,742	5·8	508
Fernhome Ailsa	Glengarry Gem's Royal	Mature	273	9,385	4·9	467
Fernhome Hopeful	Glengarry Gem's Royal	Mature	273	8,157	4·4	366
Fernhome Dot	Glengarry Gem's Royal	Mature	273	7,204	4·8	349
Fernhome Isabelle	Glengarry Gem's Royal	S.4	273	6,613	4·6	305

		GWYNNE, G., Umbiram (A.I.S., 12).				
Trevor Hill Oriole	Trevor Hill Bosca	J.4	240	5,192	4·7	246
Trevor Hill Eva	Trevor Hill Eclipse	J.2	273	4,713	4·1	194
Trevor Hill Daphne 2nd	Alfa Vale Reflex	J.2	273	5,889	4·2	251
Trevor Hill Maderia 3rd	Fairvale Jeweller	J.2	273	4,958	4·6	229
Millievale Charlotte 4th	Fairvale Supreme	J.2	273	5,412	4·4	240
Yarranvale Helenore	Fairvale Jellicoe	J.2	273	5,737	4·2	244
Ardilea Kitty 9th	Newstead Royal Monarch	J.2	273	6,833	3·9	269
Ardilea Gwen 13th	Newstaed Royal Monitor	J.2	273	6,957	3·8	267
Ardilea Princess 7th	Newstead Musician	J.2	273	7,363	4·2	313
Ardilea Bud 3rd	Newstead Musician	J.2	273	6,956	4·1	291
Ardilea Princess 6th	Newstead Musician	J.2	273	6,471	4·1	268
Ardilea Sadie 8th	Newstead Musician	S.2	273	5,581	4·3	242
		HARCH, E., Laidley (A.I.S., 2).				
Hillfield Ethel 2nd	Bingleigh Jean's Emperor	J.2	273	7,585	4·4	337
Bingleigh Melody Pearl 7th	Blacklands Emblem	Mature	273	9,821	3·7	365
		HART BROS., Clifton (A.I.S., 7).				
Bileena Buttercup 20th	Tara Bright Star	S.4	273	9,301	3·7	353
Bileena Bonnie 6th	Springlands Security	Mature	273	14,535	3·9	578
Ravensdale Glory	Jamberoo Best	S.2	273	6,687	4·2	286
Ravensdale Crummy	Jamberoo Best	S.2	273	4,601	3·9	180
Mount Blow Mavis 5th	Alfa Vale Sterling	S.2	273	5,898	4·6	273
Mount Blow Shamrock 9th	Alfa Vale Sterling	J.2	273	7,148	4·2	301
Mount Blow Mayflower 4th	Alfa Vale Sterling	J.2	273	4,924	4·0	201
		HARVEY, C. and B. E. C., Nobby (A.I.S., 8).				
White Park Mermaid 13th	White Park Skipper	J.3	240	4,155	4·3	180
Faimoye Rose 2nd	Melmerle Primroy	J.2	120	2,736	4·6	125
Mountain Camp Verbena	Bunya View Hero	J.3	150	3,357	4·4	148
Mountain Camp Verbena	Bunya View Hero	J.2	273	4,329	4·0	176
White Park Roseleaf 21st	White Park Bruce	J.3	240	5,364	3·8	206
White Park Polly 41st	White Park Bruce	J.4	240	5,409	4·1	221
White Park Edna 52nd	White Park Radiant	S.2	273	6,094	4·0	244
White Park Dairymaid 36th	White Park Radiant	S.2	273	4,350	4·2	184

TABLE 12—*continued.*

RECORDS OF COWS COMPLETING LACTATION RECORDS DURING THE YEAR ENDED 30TH JUNE, 1951—*continued.*

Cow.	Sire.	Age.	Days Recorded.	Production. Milk.	Test.	Butterfat.
				Lb.	%	Lb.
	HENRY, Mrs. K., Greenmount (A.I.S., 8).					
*Tara Hilda 3rd	Alfa Vale Plumber	Mature	273	9,292	3·8	361
*Tara Hilda 4th	Alfa Vale Plumber	S.3	273	7,677	3·9	302
Tara Buttercup 5th	Alfa Vale Plumber	Mature	273	7,510	2·9	224
Tara Cleo 3rd	Tara Magnet's Gift	Mature	273	6,761	4·3	294
Tara Jewel 2nd	Murray Bridge Pansy's Gift	Mature	273	8,411	4·1	347
Tara Cleo 7th	Tara Foch	S.2	273	5,729	3·9	224
Tara Laura 12th	Bileena Bonnie's Prince	S.2	273	4,993	3·8	191
Tara Hope 6th	Bileena Bonnie's Prince	S.2	120	2,115	3·6	78
	HEADING, C. A., Maleny (A.I.S., 7).					
Headlands Don's Necklace	Headlands Lulu's Don	Mature	240	7,149	5·0	275
Wilga Plains Dorothy	Headlands Red Jacket	Mature	273	6,877	4·0	275
Wilga Plains Trilby 6th	Highfields Guardsman	Mature	240	6,240	4·0	249
Wilga Plains Fortune 3rd	Wilga Plains Trump	S.4	273	6,050	4·1	249
Wilga Plains Charm 13th	Highfields Rocket	J.2	273	5,694	4·2	242
Wilga Plains Trilby 13th	Highfields Champion	J.2	273	6,220	3·9	242
Wilga Plains Tot	Highfields Champion	J.2	273	5,668	4·2	241
	HENSCHELL, W., Yarranlea (A.I.S., 15).					
*Fairvale Laurel 2nd	Bingleigh Jean's Monarch	Mature	365	28,884	3·6	1,062
Trevor Hill Bonnie	Corunna Supreme	Mature	273	12,658	4·1	519
Yarranvale Empress	Trevor Hill Bosca	Mature	273	9,558	3·8	365
Yarranvale Jean 3rd	Yarranvale Picture's Prince	J.2	273	6,153	3·8	236
Yarranvale Minerva 4th	Fairvale Cheerio	S.2	273	8,985	4·4	396
Yarranvale Evelyn 4th	Fairvale Cheerio	J.2	273	6,805	4·1	280
Fairvale Ethel 13th	Fairvale Reward	Mature	180	4,974	3·7	185
Yarranvale Minerva	Fairvale Reward	S.3	240	7,338	4·0	295
Blanchview Dawn	Fairvale Reward	S.4	273	9,765	4·1	403
Yarranvale Hansome	Fairvale Jeweller	J.3	273	8,658	3·7	319
Yarranvale Minerva 3rd	Fairvale Jeweller	J.3	210	5,625	4·0	229
Yarranvale Jean 2nd	Fairvale Jeweller	J.3	240	7,161	3·6	260
Yarranvale Judy	Fairvale Jeweller	S.2	120	3,480	4·3	151
Trevor Hill Fancy	Fairvale Jeweller	J.2	240	4,319	3·5	153
Trevor Hill Noella	Fairvale Jeweller	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

	HERZIG, R. W., Clifton (A.I.S., 3).					
Talgai Vale Grace	Jamberoo Butterboy	J.3	273	6,145	4·4	274
Talgai Vale Crummy	Jamberoo Butterboy	J.3	273	6,573	4·0	265
Talgai Vale Grace 2nd	Jamberoo Butterboy	J.2	273	5,461	4·5	250
	HINRICHSEN and SONS, Clifton (A.I.S., 5).					
Ardilea Nessie 12th	Ardilea Socialist	J.2	273	5,097	4·9	194
Ardilea Princess 5th	Ardilea Socialist	J.2	273	5,954	4·1	246
Ardilea Broady 16th	Newstead Royal Monitor	J.2	273	5,810	4·2	245
Ardilea Flower 24th	Newstead Royal Monitor	J.2	273	6,792	3·3	230
Ardilea Gwen 12th	Newstead Royal Monitor	J.2	273	4,991	4·2	210
	HORROCKS, W. J., Maclagan (A.I.S., 10).					
Grahamville Jean 2nd	White Park Ronald	J.4	273	7,784	4·8	370
Grahamville Mafalda 2nd	Millievale Gregory	J.2	273	6,767	3·7	253
Grahamville Gentle 2nd	Millievale Gregory	J.2	273	5,428	3·7	202
Grahamville Sapphire 2nd	Millievale Gregory	J.2	273	4,913	4·0	197
Grahamville Susy	Sunnyview Principal	J.3	210	4,208	4·1	173
Grahamville Diamond 2nd	Sunnyview Principal	J.3	180	3,717	4·5	168
Grahamville Duchess	Sunnyview Principal	S.2	273	6,857	3·8	265
Grahamville Thelma	Sunnyview Principal	J.2	273	5,712	3·6	207
Grahamville Mafalda	Sunnyview Principal	J.2	273	4,959	3·9	195
Grahamville Diamond 2nd	Sunnyview Principal	J.2	240	5,115	3·4	178
	JACKSON, E. W., Nobby (A.I.S., 13).					
Navillus Princess 12th	Greyleigh Eros	S.3	240	6,384	4·1	265
Ennismore Florrie	Navillus Prince Henry	Mature	273	12,448	3·7	458
Ennismore Beauty	Navillus Prince Henry	Mature	240	7,242	4·1	296
Ennismore Fancy 5th	Arolla Limerick	S.3	273	7,054	3·9	274
Ennismore Rose Marie 2nd	Arolla Limercik	J.3	273	6,966	4·1	285
Ennismore Emma 4th	Arolla Limerick	J.3	240	5,901	3·7	221
Ennismore Fussy 3rd	Arolla Limerick	S.2	273	5,621	4·5	257
Ennismore Rose Marie 3rd	Arolla Limerick	S.2	210	4,479	3·9	175
Ennismore Countess 2nd	Arolla Limerick	J.2	273	5,697	4·5	258
Ennismore Ruth 4th	Arolla Limerick	J.2	273	5,510	4·2	235
Ennismore Florrie 3rd	Arolla Limerick	J.2	273	4,468	4·2	188
Ennismore Ramona 3rd	Arolla Limerick	J.2	240	3,750	4·4	165
Ennismore Necia 3rd	Arolla Limerick	J.2	180	2,943	4·5	131

TABLE 12—*continued.*

RECORDS OF COWS COMPLETING LACTATION RECORDS DURING THE YEAR ENDED 30TH JUNE, 1951—*continued.*

Cow.	Sire.	Age.	Days Recorded.	Production. Milk.	Test.	Butterfat.
				Lb.	%	Lb.
	KRAUSE, H. C. A., Thangool (A.I.S., 5).					
Springlands Polly 3rd	Blacklands Joan's Monarch	J.2	120	1,707	3·1	52
Springlands Sunbloom	Blacklands Joan's Monarch	J.2	90	858	3·9	33
Springlands Joy	Lynfield Rex	J.2	150	2,334	4·0	94
Springlands Rhonda	Lynfield Rex	J.2	180	1,953	3·8	74
Springlands Ella	Lynfield Rex	J.2	150	2,031	3·4	69
	LESTER, M. C., Glengallan (A.I.S., 20).					
*St. Andrew's Violet	Bingleigh Premier	J.4	273	10,026	4·5	452
Mountain Home Envy 3rd	Fairvale Ensign	Mature	273	13,493	4·2	565
St. Andrew's Gentle 13th	Fairvale Ensign	J.2	273	6,331	4·0	254
*St. Andrew's Gem 10th	Tabbagong Victory	S.3	210	9,339	4·2	393
St. Andrew's Gem 16th	Tabbagong Victory	S.3	240	7,590	4·4	334
St. Andrew's Violet 2nd	Tabbagong Victory	J.3	273	5,632	3·7	210
St. Andrew's Olive	Tabbagong Victory	S.2	273	10,287	4·2	430
*St. Andrew's Gentle 4th	Tabbagong Victory	S.2	273	7,329	4·0	300
*St. Andrew's Gem 20th	Tabbagong Victory	S.2	273	8,717	4·0	350
St. Andrew's Envy	Tabbagong Victory	S.2	210	6,495	3·9	256
St. Andrew's Gem 13th	Tabbagong Victory	S.2	240	5,004	4·0	205
St. Andrew's Honeycombe 3rd	Tabbagong Victory	J.2	273	8,417	4·0	335
St. Andrew's Gentle 9th	Tabbagong Victory	J.2	273	6,404	4·1	263
St. Andrew's Gem 27th	Tabbagong Victory	J.2	273	6,311	3·8	245
St. Andrew's Gem 28th	Tabbagong Victory	J.2	273	6,465	3·7	238
St. Andrew's Gem 22nd	Tabbagong Victory	J.2	240	5,247	4·4	231
St. Andrew's Ivy 5th	Tabbagong Victory	J.2	273	5,003	4·1	203
St. Andrew's Ivy 4th	Tabbagong Victory	J.2	240	4,493	3·9	174
St. Andrew's Gentle 5th	Tabbagong Victory	J.2	273	6,250	4·3	269
St. Andrew's Gentle 7th	Tabbagong Victory	J.2	150	3,024	3·7	113

Faversham Prim 3rd	Chelmer Redman	Mature	273	8,578	3·7	322
Faversham Prim 3rd	Chelmer Redman	Mature	273	8,901	3·8	342
Faversham Dewdrop 5th	Chelmer Redman	Mature	273	9,083	3·4	310
Balcarres Madam 9th	Alfa Vale Marshall	S.2	273	6,906	3·6	255
Balcarres Handsome 4th	Alfa Vale Marshall	J.2	273	5,207	4·2	220
Balcarres Marshall's Poppet	Alfa Vale Marshall	J.2	240	4,404	3·8	168
Balcarres Heather 7th	Balcarres Bachelor	J.3	273	5,600	3·7	211
Balcarres Bessie 5th	Balcarres Bachelor	J.3	240	4,989	3·6	181
Wongalea Glory	Balcarres Banker 2nd	J.2	210	2,748	3·8	106
Faversham Ruby 40th	Girraween Gideon	S.2	273	4,729	3·9	187
Faversham Bud 40th	Girraween Gideon	J.3	273	6,537	3·4	225
Ehlma Park Duchess 2nd	Ehlma Park Red Clover	Mature	273	8,176	3·2	268
Calrossie Carmen 9th	Alfa Vale Module	J.3	240	3,657	3·8	140
Balcarres Faith 9th	Rosenthal Envoy	Mature	273	10,835	3·6	390
Wongalea Gem	Valera Daphne's Prince 2nd	J.2	273	5,077	3·8	197
Wongalea Jean	Valera Daphne's Prince 2nd	J.2	273	4,851	3·8	186
Wongalea Gracie	Valera Daphne's Prince 2nd	J.2	273	3,779	3·8	146
Ehlma Park Pearl 40th	Valera Daphne's Prince 2nd	J.2	210	3,402	3·5	121
Faversham Dimple 7th	Croydon Marchese	Mature	273	8,412	3·0	256
Faversham Gem 6th	Croydon Marchese	Mature	273	8,438	3·8	322
Faversham Ruby 10th	Croydon Marchese	Mature	273	8,436	3·7	315
Balcarres Major's Beauty	Balcarres Major 4th	S.4	273	7,853	3·6	283
Wongalea Linda	Balcarres Major 4th	S.4	273	6,728	4·0	269
	MADGE BROS., Southbrook (A.I.S., 2).					
Emby Vale Coupon	Braemar Ringleader	J.3	273	9,224	4·1	380
Emby Vale Duchess	Barkworth Master	J.2	180	6,495	4·1	263
	MARQUARDT, A. C., Mondure (A.I.S., 1).					
Cedar Valley Foremost 2nd	Kyabram Masterpiece	S.2	273	7,084	3·9	280
	McLENNAN, T., Willowvale (A.I.S., 16).					
Murcott Petunia	Bileena Challenge	Mature	273	7,721	3·2	251
Murcott Nancy 2nd	Rosana Red Radiance	J.4	273	5,987	3·5	214
Murcott Clara 3rd	Rosana Red Radiance	J.4	273	9,689	4·3	421
Murcott Petunia 7th	Murcott Royal	J.2	273	7,140	3·8	268
Murcott Charm 5th	Murcott Royal	J.2	273	6,774	3·7	250
Murcott Nancy 6th	Murcott Royal	J.2	273	5,771	3·5	204
Murcott Clara 9th	Murcott Royal	J.2	273	4,408	4·3	190
Murcott Laurel 7th	Murcott Royal	S.2	273	6,459	3·9	251
Murcott Laurel 3rd	Fairthorn Rainbow's Prince	J.3	273	10,472	3·4	364
Murcott Laurel 5th	Fairthorn Rainbow's Prince	J.2	273	6,798	3·9	268
Murcott Laurel 6th	Fairthorn Rainbow's Prince	J.2	273	6,931	3·8	269
Murcott Nancy 4th	Fairthorn Rainbow's Prince	J.2	273	5,784	3·8	223
Murcott Petunia 3rd	Fairthorn Rainbow's Prince	J.2	273	5,074	3·3	169
Murcott Opal 2nd	Fairthorn Rainbow's Prince	J.2	273	8,106	3·8	311
Murcott Charm 4th	Fairthorn Rainbow's Prince	J.2	273	6,383	3·9	249
Murcott Petunia 4th	Fairthorn Rainbow's Prince	S.2	240	7,083	3·4	244

TABLE 12—*continued.*

RECORDS OF COWS COMPLETING LACTATION RECORDS DURING THE YEAR ENDED 30TH JUNE, 1951—*continued.*

Cow.	Sire.	Age.	Days Recorded.	Production. Milk.	Test.	Butterfat.
				Lb.	%	Lb.
MITCHELL AND MULCAHY, S., Warwick (A.I.S., 16).						
Rosenthal Lilac 13th	Fairlie Senator	Mature	273	7,646	3·9	305
Rosenthal Lilac 26th	Warahgai Trafalgar	J.2	273	4,986	4·0	201
Rosenthal Fairlie Princess 68th	Rosenthal Victory	S.2	273	5,513	4·2	234
Fairlie Fuschia 31st	Rosenthal Victory	J.2	273	5,538	3·7	210
Fairlie Chrissie 30th	Rosenthal Gay Knight	S.2	273	8,286	3·7	311
Rosenthal Lilac 25th	Rosenthal Gay Knight	J.2	273	6,605	3·6	239
Rosenthal Lilac 23rd	Rosenthal Gay Knight	J.3	273	7,509	3·5	264
Rosenthal Perfect 18th	Rosenthal Gay Knight	J.3	240	5,668	4·0	226
Rosenthal Choice 23rd	Rosenthal Gay Knight	S.3	273	6,101	4·2	255
Rosenthal Choice 24th	Rosenthal Gay Knight	S.3	273	6,300	4·0	249
Rosenthal Handsome 46th	Rosenthal Gay Knight	Mature	273	5,652	4·6	259
Rosenthal Perfect 17th	Valera Reward	S.3	273	6,788	4·2	286
Fairlie Princess 65th	Valera Reward	S.3	273	6,394	4·4	282
Rosenthal Rosebud 24th	Valera Reward	S.2	273	7,112	4·1	293
Rosenthal Perfect 17th	Valera Reward	S.2	273	6,399	4·2	274
Fairlie Princess 66th	Valera Reward	S.2	273	5,546	4·0	222
NEALE, D. G., Pittsworth (A.I.S., 9).						
Alfa Vale Myrtle 8th	Alfa Vale Paisley	J.2	240	6,081	4·3	259
Alfa Vale Beauty 8th	Alfa Vale Paisley	J.2	240	4,569	4·1	190
Blacklands Jean 35th	Blacklands Czar	J.3	273	7,575	4·1	314
Blacklands Jean 38th	Blacklands Limerick	J.3	273	7,718	3·8	299
Blacklands Miss Dairymaid 14th	Blacklands Topsy's Elect	J.2	273	5,388	3·8	205
Yarranvale Remembrance	Fairvale Jellicoe	J.2	273	8,013	3·2	258
Yarranvale Gift	Fairvale Jeweller	S.2	180	5,163	3·4	178
Blacklands Flower 21st	Blacklands Maiden's Monarch	J.3	273	5,951	3·8	227
Blacklands Lady Myrtle 34th	Blacklands Maiden's Monarch	S.2	273	6,504	4·1	267

	O'SULLIVAN, C., Greenmount (A.I.S., 8).					
*Navillus Charm 17th	Greyleigh Eros	Mature	273	13,550	3·9	524
Navillus Charm 18th	Greyleigh Eros	Mature	273	9,087	3·4	311
Meadowstream Gem 2nd	Greyleigh Quality	J.2	273	6,338	4·3	278
Navillus Gem 4th	Blacklands Candidate	J.2	273	6,258	4·1	260
Navillus Carnival's Plum 8th	Navillus Carnival	J.3	273	7,157	3·7	269
Brundah Susie	Navillus Radiant	Mature	273	9,207	3·5	322
*Swanlea Diana 14th	Alfa Vale Loyal	Mature	273	12,642	4·0	500
Navillus Gem 3rd	Navillus Bright Light	J.3	273	11,320	4·2	482
	POWER, M. F., Kapaldo (A.I.S., 7).					
Vermont Hazel 27th	Vermont Elect	Mature	273	8,423	4·1	347
Blacklands Jean 34th	Blacklands Gloucester	J.3	273	5,439	4·2	233
Wattleview Daffodil 3rd	Fairholm Gilpin	J.2	273	5,869	4·2	249
Wattleview Agatha 8th	Fairholm Gilpin	J.2	120	1,401	3·5	49
Blacklands Foremost 47th	Blacklands Topsy's Elect	S.4	120	3,207	3·7	120
Blacklands Pretty Jean 19th	Blacklands Topsy's Elect	S.2	120	1,449	3·9	57
Wattleview Diana	Applegarth Noble	Mature	273	9,191	3·9	367
	Q.A.H.S. AND COLLEGE, Lawes (A.I.S., 7).					
College Rapture 12th	Alfa Vale Pursue	J.2	273	7,382	4·3	317
Ennismore Nancy 5th	Arolla Limerick 3rd	S.2	273	6,785	3·9	271
College Raceme 6th	Alfa Vale Pride 2nd	J.4	273	7,750	4·2	333
Bingleigh Myrtle 3rd	Blacklands Jean's Victory	Mature	273	7,920	3·9	316
Bingleigh Miss Ettie 2nd	Blacklands Jean's Victory	S.2	273	8,828	4·4	397
Bingleigh Beauty	Blacklands Jean's Victory	S.2	240	5,415	4·1	227
Bingleigh Miss Jean 9th	Blacklands Jean's Victory	S.2	273	5,267	3·8	203
	RUHLE, K. A., Motley (A.I.S., 1).					
Trevor Hill Marlene	Fairvale Jeweller	J.2	273	7,918	4·3	343
	SANDERSON, W., Mulgeldie (A.I.S., 9).					
Logiebank Dainty 36th	Parkview Talisman	S.2	273	7,409	3·7	277
Sunlit Farm Pride's Poppy	Alfa Vale Pansy's Pride	J.2	273	7,048	3·7	267
Sunlit Farm Ida 11th	Sunlit Farm Madam's Victory	S.4	273	9,324	3·9	366
Sunlit Farm Flower 7th	Sunlit Farm Madam's Victory	S.2	273	7,629	4·1	309
Sunlit Farm Ida 14th	Sunlit Farm Madam's Victory	S.2	273	7,701	3·8	298
Sunlit Farm Ita 17th	Sunlit Farm Madam's Victory	J.2	273	6,887	3·9	270
Sunlit Farm Ivy 2nd	Sunlit Farm Madam's Victory	J.2	273	6,156	3·9	243
Sunlit Farm Ida 15th	Sunlit Farm Madam's Victory	J.2	273	6,042	4·0	242
Sunlit Farm Flower 7th	Sunlit Farm Madam's Victory	J.2	273	4,959	3·8	192

TABLE 12—*continued.*

RECORDS OF COWS COMPLETING LACTATION RECORDS DURING THE YEAR ENDED 30TH JUNE, 1951—*continued.*

Cow.	Sire.	Age.	Days Recorded.	Production. Milk.	Test.	Butterfat.
				Lb.	%	Lb.
SANDILANDS, A., Warwick (A.I.S., 17).						
Penrhos Maggie 21st	Alfa Vale Superb	S.2	273	5,991	3·9	239
Penrhos Dulcie 14th	Alfa Vale Superb	J.2	120	1,737	3·3	58
Penrhos Maggie 22nd	Alfa Vale Superb	J.2	273	5,261	3·9	207
Penrhos Nanette 19th	Alfa Vale Superb	J.2	210	3,864	3·6	142
Penrhos Ruth 14th	Alfa Vale Superb	J.2	240	4,509	3·9	179
Penrhos Handsome 30th	Rosenthal Macarthur	S.3	273	6,028	3·5	238
Penrhos Sally 6th	Rosenthal Macarthur	J.3	273	6,289	4·3	277
Penrhos Handsome 33rd	Rosenthal Macarthur	J.3	273	4,980	3·9	199
Penrhos Bonnie 12th	Rosenthal Macarthur	S.2	273	5,450	3·9	213
Penrhos Elva 22nd	Rosenthal Macarthur	S.2	240	4,752	4·0	190
Penrhos Maggie 20th	Rosenthal Macarthur	J.2	273	6,909	3·4	241
Penrhos Evelyn 18th	Rosenthal Macarthur	J.2	273	6,748	3·6	248
Penrhos Handsome 34th	Rosenthal Lochinvar	S.2	273	6,028	4·0	244
Penrhos Merle 16th	Rosenthal Lochinvar	S.2	240	5,400	3·8	210
Penrhos Sheila 21st	Rosenthal Lochinvar	J.2	273	5,797	4·0	232
Penrhos Sheila 20th	Rosenthal Lochinvar	S.2	273	5,925	3·9	233
Penrhos Evelyn 17th	Rosenthal Lochinvar	S.2	240	4,467	4·3	195
SCOTT, W. AND A. G., Blackbutt (A.I.S., 6).						
Aynesley Pearl 6th	Alfa Vale Pride 6th	S.3	273	7,765	4·0	316
Wilga Plains Trilby 3rd	Wilga Plains Robin	Mature	210	6,288	3·4	219
Wilga Plains Florrie 6th	Highfields Rocket	J.2	273	5,381	3·7	200
Aynesley Girlie 7th	Newstead Chancellor	Mature	273	6,666	3·4	232
Ronnoc Bluebell 3rd	Ronnoc Emblem	Mature	273	10,098	3·7	370
Aynesley Marlene	Alfa Vale Essential	Mature	273	10,169	4·3	439
SKERMAN, I. B., Kaimkillenbun (A.I.S., 32).						
Rippley Park Bella 4th	Glenroy Security	J.4	273	7,986	4·2	341
Rippley Park Fussy 3rd	Yarranvale Picture's Emblem	J.2	273	5,588	4·2	236
Moola Sweet Briar 2nd	Navillus Vera's 3rd Re-Nell	J.2	240	5,400	3·9	215
Fairvale Princess Doris	Fairvale Macarthur	J.2	273	5,564	4·0	224
Fairvale Princess Doris	Fairvale Macarthur	J.3	273	7,925	4·1	323
Fairvale Iris 2nd	Fairvale Macarthur	J.3	150	3,045	5·0	152
Fairvale Crystal	Fairvale Red Prince	J.4	210	4,320	3·7	163

Moola Sweet Briar 3rd	Navillus Plumdale	J.3	210	5,715	3·8	223
Fairvale Dainty 6th	Fairvale Czar	Mature	180	4,905	3·9	192
Fairvale Iris	Fairvale Award	Mature	240	5,828	4·7	277
Rippley Park Gem 2nd	Rippley Park Monarch	J.2	273	6,312	3·7	233
Faversham Gem 11th	Girraween Gideon	S.2	273	5,268	3·9	210
Rippley Park Nancy 2nd	Newstead Justice	Mature	240	6,165	4·3	270
Rippley Park Mossrose 7th	Trevor Hill Reflection	S.2	273	5,622	3·8	214
Rippley Park Thistle 7th	Trevor Hill Reflection	S.2	240	4,680	3·7	175
Rippley Park Doris	Trevor Hill Reflection	J.3	210	5,280	4·0	214
Rippley Park Spray	Trevor Hill Reflection	J.3	273	5,012	3·5	176
Rippley Park Spray	Trevor Hill Reflection	J.4	273	8,657	3·6	310
Rippley Park Rosebud 7th	Mountain Camp Joker	J.2	273	4,872	3·7	183
Rippley Park Thelma 2nd	Mountain Camp Joker	J.2	273	5,145	3·7	192
Rippley Park Mafalda 2nd	Mountain Camp Joker	J.2	273	5,177	4·0	209
Rippley Park Nancy 5th	Mountain Camp Joker	J.2	273	6,050	4·3	263
Rippley Park Mafalda	Mountain Camp Joker	J.2	273	5,070	4·1	213
Rippley Park Melba 4th	Mountain Camp Joker	J.2	210	3,660	4·1	151
Rippley Park Melba 3rd	Mountain Camp Joker	J.2	273	5,277	4·2	223
Rippley Park Dainty 2nd	Mountain Camp Joker	J.2	273	5,030	4·1	209
Rippley Park Shannon	Mountain Camp Joker	J.2	240	4,230	4·0	173
Rippley Park Shannon 3rd	Mountain Camp Joker	J.2	273	6,107	3·9	238
Rippley Park Princess Doris 2nd	Mountain Camp Joker	J.2	273	6,771	3·9	265
Rippley Park Rosebud 8th	Mountain Camp Joker	J.2	273	6,861	3·7	256
Rippley Park Princess	Mountain Camp Joker	S.2	273	6,518	4·0	267
Rippley Park Mafalda	Mountain Camp Joker	J.3	240	6,525	4·3	281

SPERLING, G., Kooralgin (A.I.S., 12).

Blacklands Envy 48th	Blacklands Topsy's Elect	S.3	240	5,823	4·0	237
Highfields Caroline 18th	Blacklands Thor	J.3	273	7,113	3·9	283
Highfields Rosina 15th	Blacklands Thor	S.3	240	6,248	3·2	201
Highfields Perfect 42nd	Highfields Starlight	J.4	273	8,168	3·8	316
Highfields Maureen 3rd	Highfields Tiger	J.3	273	7,280	3·9	287
Highfields Perfect 45th	Highfields Tiger	S.3	240	6,246	3·4	218
Chelmer Maureen 4th	Blacklands Defender	J.2	273	6,525	4·6	301
Highfields Ethel 15th	Laguna Emblem	J.3	273	6,902	4·2	291
Blacklands Amy 7th	Parkview Alexander	S.3	210	3,936	3·5	138
Blacklands Flower 20th	Blacklands Czar	S.3	180	3,417	4·1	140
Blacklands Melba 23rd	Blacklands Gloucester	S.3	273	6,331	3·9	251
Cedar Valley Queenie 3rd	Kyabram Masterpiece	S.2	273	5,943	4·1	244

TABLE 12—*continued.*

RECORDS OF COWS COMPLETING LACTATION RECORDS DURING THE YEAR ENDED 30TH JUNE, 1951—*continued.*

Cow.	Sire.	Age.	Days Recorded.	Production.		
				Milk.	Test.	Butterfat.
				Lb.	%	Lb.
	SULLIVAN, D., Pittsworth (A.I.S., 15).					
Ardilea Nessie 12th	Ardilea Socialist	S.2	273	7,378	3·4	249
Valera Fairy 6th	Alfa Vale Pride 2nd	Mature	273	10,004	4·3	437
Bantry Nellie 5th	Bantry Nancy's Prince	J.2	273	9,259	4·0	367
Bantry Bonnie 5th	Bantry Nancy's Prince	J.2	210	6,324	3·8	239
Bantry Model 4th	Bantry Nancy's Prince	S.2	210	4,521	4·9	222
Bantry Choice 6th	Bantry Commodore	J.2	273	6,011	4·4	270
Bantry Model 3rd	Bantry Commodore	S.2	240	6,726	4·1	280
Bantry Choice 5th	Bantry Commodore	J.3	210	6,201	4·4	273
Bantry Bonnie 2nd	Bantry Commodore	S.3	180	6,357	3·8	245
Bantry Rose 4th	Bantry Commodore	S.3	240	5,856	4·1	240
Bantry Maiden	Rosenthal Surplus 2nd	J.4	273	9,216	3·8	356
Bantry Lila	Rosenthal Surplus 2nd	J.4	273	10,868	4·4	481
Bantry Nellie 2nd	Rosenthal Surplus 2nd	S.4	240	8,553	3·8	323
Bantry Rosebud	Rosenthal Surplus 2nd	Mature	273	8,380	4·2	350
Bantry Sally	Rosenthal Surplus 2nd	Mature	273	11,235	3·9	448
	SULLIVAN, F. B., Pittsworth (A.I.S., 6).					
Fermanagh Roseleaf 16th	Fermanagh Prince	J.2	273	5,389	4·5	244
Fermanagh Roseleaf 4th	Alfa Vale Pride 2nd	J.4	273	7,404	3·7	277
Fermanagh Roseleaf 5th	Alfa Vale Pride 2nd	J.4	240	5,655	3·9	223
Fermanagh Roseleaf 15th	Valera Daphne's Prince	J.2	273	4,198	4·0	171
Fermanagh Pearlie	Valera Roseleaf's Pride	S.4	180	3,696	3·8	141
Fermanagh Shiela 3rd	Valera Roseleaf's Pride	J.4	180	4,689	4·1	195
	SULLIVAN BROS., Pittsworth (A.I.S., 8).					
Valera Jean	Valera Roseleaf's Reflection	J.2	273	8,651	4·5	389
Valera Pride's Bonny	Alfa Vale Pride 2nd	J.4	273	11,704	4·0	476
Valera Nancy 6th	Alfa Vale Pride 2nd	J.2	273	7,710	4·3	331
Valera Bounce 8th	Alfa Vale Pride 2nd	J.2	240	6,879	4·0	278
Valera Lila 27th	Alfa Vale Pride 2nd	J.2	273	5,274	4·2	222
Valera Una 9th	Valera Monarch	J.2	273	6,273	4·1	258
Valera Bonny 17th	Valera Monarch	J.2	273	6,410	4·7	302
Valera Sally 8th	Valera Monarch	J.2	273	7,416	4·1	310

	SULLIVAN, Estate M. T., Beaudesert (A.I.S., 1).					
Burnsland Dainty	Fairvale Dainty's Pride	Mature	240	5,112	4·2	217
	WALTERS, F. W., Booyal (A.I.S., 1).					
Vermont Hazel 20th	Springlands Royal Light	Mature	210	5,097	3·6	188
	WATSON, H. G., Killarney (A.I.S., 5).					
Wenlock Myrtle	Parkview Limerick	S.2	273	6,312	4·0	256
Wenlock Gem	Parkview Limerick	J.2	273	6,466	3·8	252
Wenlock Countess 3rd	Parkview Limerick	J.2	273	5,993	3·9	239
Wenlock Vanity	Parkview Limerick	J.2	273	5,160	4·1	214
Wenlock Shannon	Parkview Limerick	J.2	273	5,875	3·8	226
	WEBSTER, A. H., Helidon (A.I.S., 1).					
Millievale Envy 3rd	Fairvale Supreme	J.2	240	7,647	4·4	334
	WOODFORD, A. P., Kapaldo (A.I.S., 6).					
Dainview Primrose	Alfa Vale Rupert	J.2	273	5,789	4·0	234
Merlewood Buttercup	Alfa Vale Magee	J.2	273	6,900	3·7	257
Arley Buttercup 31st	Alfa Vale Statesman	Mature	273	8,825	4·1	359
Alfa Vale Emily 10th	Alfa Vale Pat	Mature	273	11,055	3·7	418
Alfa Vale Star 14th	Alfa Vale Pat	Mature	240	8,424	4·1	343
Alfa Vale Dandy 19th	Alfa Vale Pat	Mature	273	7,664	4·0	308
	YOULES, R. J. E., Kilcoy (A.I.S., 5).					
Normanby Poppy 2nd	Blacklands Red Knight	S.3	273	10,453	3·6	386
Kapleton Maiden	Rhodesview Royal Lad	J.4	273	6,212	3·8	240
Glen Idol Laurel 4th	Glen Idol Coronet	J.3	273	4,401	3·6	159
Glen Idol Jenny 15th	Blacklands True Blue	J.3	273	4,881	3·9	189
Happy Hill Red	Euroa Sceptre	S.3	240	4,473	4·1	185
	AYRSHIRE.					
	HOLMES, L., Yarranlea (Ayrshire, 9).					
Benbecula Janie	Benbecula Tony	J.2	273	5,894	4·2	250
Benbecula Tasma	Benbecula Tony	J.2	273	3,653	4·2	156
Benbecula Twilight	Benbecula Tina's Willie	Mature	273	9,134	3·4	314
Benbecula Fairy	Benbecula Marquis	Mature	273	8,446	3·9	338
Benbecula Thistledown	Benbecula Marquis	J.4	273	9,231	3·6	332
Benbecula Bethania	Benbecula Marquis	S.2	240	5,361	4·3	233
Benbecula Lana	Benbecula Marquis	J.2	273	4,642	4·2	196
Benbecula Trudy	Benbecula Marquis	J.2	273	5,015	3·8	192
Benbecula Bounty	Benbecula Marquis	J.2	273	4,452	3·8	170

TABLE 12—*continued.*

RECORDS OF COWS COMPLETING LACTATION RECORDS DURING THE YEAR ENDED 30TH JUNE, 1951—*continued.*

Cow.	Sire.	Age.	Days Recorded.	Production. Milk.	Test.	Butterfat.
				Lb.	%	Lb.
MANN, N. J., Broxburn (Ayrshire, 6).						
Crescent Farm Junice	Crescent Farm Bellboy	J.2	273	7,782	3·9	301
Crescent Farm Model	Crescent Farm Bellboy	J.2	273	6,856	4·0	277
Crescent Farm Lady Isabel	Crescent Farm Bellboy	J.2	273	5,505	3·9	214
Crescent Farm Bebe	Myola Orphan Boy	Mature	273	9,186	3·9	360
Crescent Farm June 2nd	Myola Orphan Boy	Mature	273	7,979	4·0	316
Crescent Farm June 2nd	Myola Orphan Boy	Mature	240	7,449	3·5	267
MATHIE, E. AND SONS, Maleny (Ayrshire, 3).						
Ainslie Lady June	Crescent Farm Milkboy	J.2	273	6,369	4·0	252
Ainslie Aileen	Ainslie Adair	J.2	240	4,986	4·2	207
Ainslie Lotus	Ainslie Reliance	S.2	273	6,374	4·5	285
NOBLE, H. R., Wanora (Ayrshire, 2).						
Auchen Eden Gay Duchess	Oatlands Duke	J.2	273	6,175	3·9	240
Auchen Eden Briar	Oatlands Duke	J.2	273	5,672	3·8	216
NORGAARD, L. AND N., Nara (Ayrshire, 8).						
Holm Park Beauty 2nd	Myola Jellicoe 2nd	S.4	273	8,096	3·7	300
Holm Park Bonnie Myrtle 2nd	Myola Jellicoe 2nd	J.4	273	7,594	4·5	343
Holm Park Gaiety	Myola Jellicoe 2nd	J.4	240	4,245	4·1	177
Holm Park Mist	Myola Jellicoe 2nd	S.2	273	6,189	4·2	265
Holm Park Miriam	Beltania Judy's Joss	J.2	273	4,989	4·1	207
Holm Park Bonnie Myrtle 3rd	Beltania Judy's Joss	J.2	273	6,266	4·0	253
Eden Farm Lady Belle	Myola Jean's Prince	Mature	273	8,490	3·6	309
Myola Miriam	Myola Jellicoe	Mature	273	9,464	3·7	358
RUHLE, J. P., Motley (Ayrshire, 5).						
Leafmore Helen 2nd	Myola Bessemer	Mature	273	8,091	3·8	310
Leafmore Jennifer	Myola Perfection	S.3	273	5,717	4·1	234
Leafmore Patience	Myola Perfection	J.3	273	6,073	4·0	243
Leafmore Shirley 2nd	Leafmore Bonny Jock	Mature	273	5,243	4·1	214
Leafmore Purity	Leafmore Bonny Jock	Mature	210	4,908	4·0	195

	SCOTT, J. N., Camp Mountain (Ayrshire, 8).					
Auchen Eden Pamela	St. Christopher's Marquis	J.3	273	7,864	4·7	376
Crescent Farm Nicety	Crescent Farm Popeye	S.3	273	5,581	4·2	238
Auchen Eden Griselda	Auchen Eden Gay Edgar	S.4	273	8,760	4·1	362
Auchen Eden Madelyn	Auchen Eden Archibald	S.3	273	8,252	4·5	376
Auchen Eden Berenice	Oatlands Duke	J.2	273	7,674	4·4	340
Auchen Eden Tallulah	Oatlands Duke	J.2	273	7,236	4·5	326
Auchen Eden Marianne 2nd	Oatlands Duke	J.2	273	6,875	4·5	314
Auchen Eden Ida's Hope	Oatlands Duke	J.2	273	6,283	4·5	288
	ST. CHRISTOPHER'S LODGE, Brookfield (Ayrshire, 4).					
Iona Honor	St. Christopher's Angel Boy	J.3	273	5,798	3·9	228
St. Christopher's Olive	St. Christopher's Angel Boy	J.3	273	6,351	4·0	257
Iona Harriet	St. Christopher's Willie	S.4	180	3,933	3·9	154
St. Christopher's Nilly	Myola Jellicoe	Mature	273	6,312	4·0	253
	STIMPSONS LTD., Loganlea (Ayrshire, 13).					
Alanbank Sunflower	Alanbank Fancy Boy	J.3	273	6,942	4·1	290
Eleresley Fairy 4th	Auchen Eden Miracle	S.2	273	5,726	4·7	270
Eleresley Miss Bee 2nd	Auchen Eden Miracle	Mature	273	6,665	4·2	281
Eleresley Foliage 2nd	Eleresley Hero	S.2	273	6,291	4·3	272
Alanbank Gay Belle	Auchen Eden Gay Laddie	S.3	273	6,868	4·1	284
Eleresley Flower Girl 3rd	Oatlands Q. Dan	S.4	273	7,971	4·4	356
Eleresley Gay Girl 2nd	Oatlands Q. Dan	S.4	273	8,448	4·0	341
Eleresley Flirt 5th	Oatlands Q. Dan	J.3	273	8,574	4·2	366
Eleresley Buttercup	Oatlands Q. Dan	S.2	273	7,627	4·2	323
Eleresley Lady Bess	Oatlands Q. Dan	J.2	273	7,443	3·9	295
Eleresley Prettymaid	Oatlands Q. Dan	J.2	273	6,299	4·3	269
Eleresley Dawn	Oatlands Q. Dan	J.2	273	4,406	4·7	209
Eleresley Jonquil	Eleresley Major 2nd	Mature	273	10,946	4·6	508
	DAIRY SHORTHORN.					
	SULLIVAN, Est. M. T., Beaudesert (Dairy Shorthorn, 5).					
Millside White Daphne	Braelands Chieftain 2nd	Mature	210	4,113	3·4	139
Millside White Daphne	Braelands Chieftain 2nd	J.4	273	4,791	4·0	192
Millside Beauty 7th	Hillfield Barrington	Mature	180	2,940	3·0	88
Millside Daisy 7th	Morven Lord Cresside 41st	S.3	210	4,827	3·6	171
Yarrowee Margaret	Morven Lord Cresside 41st	S.3	240	4,011	4·2	169
	FRIESIAN.					
	GORDON, D., Oxley (Friesian, 4.)					
Burnbrae Adeline Valpiebe	Anama Transvaal Stamp	Mature	273	6,717	3·2	215
Burnbrae Myra Colantha	Wattle Bank Colantha Auplod	J.2	273	6,173	3·4	207
Burnbrae Segis Sylvia	Wattle Bank Colantha Auplod	S.3	273	8,062	3·7	297
Glendalough Fairy 3rd	Burnbrae Victory Valuman	J.2	273	8,443	3·2	274

TABLE 12—*continued.*

RECORDS OF COWS COMPLETING LACTATION RECORDS DURING THE YEAR ENDED 30TH JUNE, 1951—*continued.*

Cow.	Sire.	Age.	Days Recorded.	Production. Milk.	Test.	Butterfat.
				Lb.	%	Lb.
	MURNAME, W., Bullyard (Friesian, 3).					
Rockview June	Anama Transvaal Stamp	J.2	273	6,335	3·9	252
Rockview Sandra	Anama Transvaal Stamp	J.2	273	4,299	3·6	158
Rockview Polly	Anama Transvaal Stamp	J.4	273	5,654	3·6	208
	NAUMANN, C. H., Yarraman (Friesian, 11).					
Brigalow Dazzler 23rd	St. Athans Bell Piebe 2nd	J.3	273	7,623	3·9	299
Yarrabine Ann	Victoria Eagle	J.2	273	9,794	2·6	263
Yarrabine Nelly	Victoria Beecham	J.2	273	8,048	3·0	244
St. Athans Vic. Molly	Victoria Beecham	J.2	273	5,264	3·5	185
Rockview Bessie	Anama Transvaal Stamp	J.4.	273	7,554	3·5	267
Rockview Jessica	Anama Transvaal Stamp	J.2	273	7,422	4·0	296
Yarrabine Poppy	Rockview Clinker	J.2	273	8,207	3·3	271
Yarrabine Betsy	Rockview Clinker	J.2	273	7,024	3·5	247
Yarrabine Pee Wee	Rockview Clinker	J.2	273	5,589	3·6	199
Yarrabine Founder's Pride	Rockview Clinker	J.2	273	5,829	3·7	217
Friesleigh Gentle Ann	Youngmede Pietertje King	J.2	273	5,835	3·8	223
	GUERNSEY.					
	COOKE, W. A. K., Maleny (Guernsey, 6).					
Laureldale Liddy	Minnamurra Topsy's Sequel 2nd	Mature	273	10,917	4·2	460
Laureldale Vida 2nd	Minnamurra Topsy's Sequel 2nd	J.3	273	5,948	5·3	317
Laureldale Dawn	Minnamurra Topsy's Sequel 2nd	S.2	273	4,913	5·3	263
Laureldale Dot 3rd	Minnamurra Topsy's Sequel 2nd	J.3	273	5,813	5·1	302
Laureldale Olga 4th	Minnamurra Topsy's Sequel 2nd	Mature	273	7,794	5·5	430
Laureldale Vida	Minnamurra Topsy's Sequel 2nd	Mature	273	10,447	4·8	508

	COOKE, J. M., Maleny (Guernsey, 6).					
Eleresley Nerelle	Sunny Valley Duke	J.2	273	6,352	4·8	307
Eleresley Lynette	Sunny Valley Duke	S.2	273	5,145	4·5	234
Adaville Flowergirl	Linwood Guess	S.4	273	5,811	4·7	278
Adaville Musk	Linwood Guess	J.4	273	6,473	4·8	312
Brookland Leah	Brookland Landes Lad	S.3	273	6,287	5·1	320
Adaville Susy	Willowbrae Victory	J.2	273	4,269	5·0	215
	CRANNEY, A. J., Maleny (Guernsey, 11).					
Fernhill Silver Bell	Wollongbar Remus	J.2	273	4,464	5·0	227
Fernhill Picture	Wollongbar Remus	J.2	273	4,209	5·2	220
Fernhill Pansy	Cooroora View Pilgrim	Mature	273	5,666	4·1	236
Fernhill Sunshade	Cooroora View Chance	S.4	273	7,661	5·3	409
Fernhill Fairy Princess	Laureldale Peace Boy	Mature	273	8,568	4·6	390
Fernhill Fairy Queen	Fernhill Rose Boy	Mature	240	5,448	4·5	250
Fernhill May Rose	Fernhill Barrister	Mature	273	4,780	5·4	260
Fernhill Blossom	Fernhill Barrister	Mature	273	5,856	5·6	328
Fernhill Princess Elizabeth	Laureldale Violet's Sequel	S.3	273	5,290	5·1	272
Fernhill Princess Marie	Laureldale Violet's Sequel	J.2	273	4,611	4·6	212
Fernhill May Belle	Laureldale Violet's Sequel	J.2	273	4,358	4·8	212
	DOSS, W. H., Degilbo (Guernsey, 46).					
San Jonda Prudence	Laureldale Pride	J.2	273	4,105	4·4	182
San Jonda Nancy	Laureldale Pride	J.2	273	4,574	5·0	232
San Jonda Jane	Laureldale Pride	J.2	273	4,986	4·9	247
San Jonda Bessie	Laureldale Pride	J.2	273	5,030	4·3	218
San Jonda Pet	Laureldale Pride	J.2	273	6,034	4·5	276
San Jonda Bonnie	Laureldale Pride	J.2	273	5,880	4·4	259
San Jonda Sunday	Laureldale Pride	J.2	273	5,451	4·2	232
San Jonda Peggy	Laureldale Pride	J.2	273	4,466	5·2	233
San Jonda Ladylove	Laureldale Pride	J.2	273	5,600	4·7	261
San Jonda Dawn	Laureldale Pride	J.2	273	4,820	4·3	207
San Jonda Cynthia	Laureldale Pride	J.2	273	5,732	4·7	268
San Jonda Milly	Laureldale Pride	J.2	273	5,798	4·9	282
San Jonda Grace	Laureldale Pride	J.2	273	5,199	4·7	246
San Jonda Wren	Laureldale Pride	J.2	210	3,848	4·8	183
San Jonda Golden Girl	Laureldale Pride	J.2	180	3,174	4·5	144
San Jonda Petal	Laureldale Pride	J.2	150	2,676	4·5	120
San Jonda Marigold	Laureldale Pride	J.2	150	2,700	4·0	109
San Jonda Velvet	Laureldale Pride	S.2	273	5,557	4·4	249
San Jonda Chick	Laureldale Pride	S.2	273	3,593	5·0	182

TABLE 12—*continued.*

RECORDS OF COWS COMPLETING LACTATION RECORDS DURING THE YEAR ENDED 30TH JUNE, 1951—*continued.*

Cow.	Sire.	Age.	Days Recorded.	Production. Milk.	Test.	Butterfat.
				Lb.	%	Lb.
	DOSS, W. H., Degilbo (Guernsey, 46) *continued.*					
San Jonda Josie	Laureldale Pride	S.2	273	6,712	4·1	280
San Jonda Pearl	Laureldale Pride	S.2	273	5,020	5·0	251
San Jonda Jean	Laureldale Pride	S.2	273	6,138	4·7	287
San Jonda Carn	Laureldale Pride	S.2	273	6,743	4·4	295
San Jonda Bessie	Laureldale Pride	S.2	240	5,289	4·4	232
San Jonda Prudence	Laureldale Pride	J.3	150	2,649	4·1	109
San Jonda Velvet	Laureldale Pride	S.3	273	5,730	4·9	281
Oakwood Penny	Laureldale Pride	S.3	273	7,018	4·3	303
San Jonda Jessie	San Jonda Chief	J.2	150	2,601	3·7	95
San Jonda Cheekymiss	Fairfield Winner	J.2	180	3,075	4·5	139
San Jonda Flicka	Fairfield Winner	J.2	273	5,511	4·7	262
San Jonda Pamela	Fairfield Winner	J.2	273	6,668	4·9	323
San Jonda Pansy	Fairfield Winner	J.2	273	5,367	4·2	231
San Jonda Welcome	Fairfield Winner	S.2	273	5,080	4·9	248
San Jonda Ping	Fairfield Winner	J.3	273	5,127	4·7	241
San Jonda Wallflower	Fairfield Winner	J.3	273	6,503	4·4	291
San Jonda Betty	Fairfield Winner	J.3	273	5,170	4·6	239
Oakwood Butterfly	Fairfield Winner	S.3	273	6,562	4·4	293
San Jonda Rose	Fairfield Winner	S.3	273	6,536	4·8	315
San Jonda Sunshine	Fairfield Winner	S.3	273	5,221	4·5	234
San Jonda Ping	Fairfield Winner	J.4	210	4,020	4·9	197
Oakwood Sparkle	Fairfield Winner	S.4	273	6,062	4·8	292
Oakwood Bubble	Fairfield Winner	Mature	273	4,947	5·5	276
Oakwood Cherry	Fairfield Winner	Mature	273	7,555	4·6	351
Oakwood Pattern	Fairfield Winner	Mature	273	7,157	4·3	305
Oakwood Success	Fairfield Witch Boy	Mature	273	6,647	4·7	313
Oakwood Girleen	Fairfield Witch Boy	Mature	240	5,676	4·4	248

Toba Coral ..	Linwood Hurricane	J.2	273	5,184	4·4	[illegible]
Toba Olga ..	Linwood Hurricane	J.2	273	6,340	4·7	300
Toba Gail ..	Linwood Hurricane	J.2	273	5,333	4·7	252
Toba Olwyn	Linwood Hurricane	J.2	273	3,777	4·8	183
Toba Generous	Linwood Hurricane	J.2	273	6,055	4·1	250
Toba Fancy	Linwood Hurricane	J.2	273	6,389	4·3	273
Toba Bright Girl	Linwood Hurricane	J.2	273	6,413	4·5	290
Toba Gay Girl	Linwood Hurricane	J.2	273	5,319	4·4	232
Toba Marie	Warrawong Winter	J.3	273	9,753	4·0	392
Linwood Comment	Warrawong Winter	Mature	273	7,209	4·7	342
Linwood Gloss	Warrawong Winter	Mature	273	8,121	3·9	324
Toba Dairymaid	Koojan Ace's Marshal	J.2	273	4,639	5·2	244
Linwood Finch	Linwood Peter	Mature	273	6,274	4·7	297
Linwood Chance	Laureldale Baron	Mature	273	6,282	4·4	279
Linwood Pattern	Laureldale Peace Boy	Mature	273	9,298	4·7	442
	HUTH, A., Roadvale (Guernsey, 3).					
Spurfield Aileen	Yarraview Royal Master	J.2	273	4,517	5·1	233
Spurfield Royal Fairy	Yarraview Royal Master	S.2	210	4,110	4·5	187
Glenfield Lady Belle	Brookland Coronation Boy	Mature	273	6,681	4·7	315
	JOHNSTON, D. C., Coulsen (Guernsey, 8).					
Fernhill Honesty	Fernhill Barrister	J.4	273	6,563	4·9	322
Oakwood Polly	Fairfield Winner	Mature	240	6,528	4·2	277
Adaville Sweetly	Linwood Guess	Mature	273	7,838	4·4	348
Laureldale Pamela 3rd	Bangalow Vale Guardsman	J.2	273	4,754	4·4	210
Laureldale Vera 3rd	Bangalow Vale Guardsman	J.2	273	4,716	4·7	220
Laureldale Veta 2nd	Bangalow Vale Guardsman	J.2	273	5,110	4·5	232
Laureldale Patch 2nd	Bangalow Vale Guardsman	J.2	273	5,305	4·6	245
O'Kay Sunny	Laureldale Violet's Sequel	S.2	240	5,664	5·1	288
	RUGE, A., AND SONS, Woowoonga (Guernsey, 12).					
Willowbrae Tossels	Laureldale Don	J.2	273	6,125	5·1	318
Willowbrae Ruby ..	Laureldale Don	J.2	273	6,864	4·9	341
Willowbrae Petunia	Laureldale Don	J.2	273	5,610	5·6	315
Willowbrae Queenie	Laureldale Don	J.2	273	6,640	4·6	305
Willowbrae Trilby	Laureldale Don	S.2	273	6,465	5·2	340
Willowbrae Peppermint	Laureldale Don	S.2	273	4,841	5·3	261
Springvale Topsy ..	Moongi Lloyd George	J.2	273	5,934	4·9	292
Springvale Orange	Moongi Lloyd George	S.2	273	7,397	4·9	362
Springvale Verla ..	Moongi Lloyd George	S.2	273	8,517	5·3	455
Springvale Jessie ..	Moongi Lloyd George	J.3	273	8,659	4·5	391
Springvale Curly ..	Moongi Lloyd George	S.3	273	6,305	4·6	291
Willowbrae Daffodil	Linwood Pharos	J.3	273	7,956	5·0	399

TABLE 12—*continued.*

RECORDS OF COWS COMPLETING LACTATION RECORDS DURING THE YEAR ENDED 30TH JUNE, 1951—*continued.*

Cow.	Sire.	Age.	Days Recorded.	Production.		
				Milk.	Test.	Butterfat.
				Lb.	%	Lb.
	SENTINELLA, E. C., Graceville (Guernsey, 5).					
Tattenbar Old Gold	Linwood Peer	Mature	273	8,014	4·7	376
Tattenbar Orchid	Linwood Peer	Mature	273	6,773	4·3	291
Tattenbar Oriel	Linwood Peer	Mature	273	8,458	4·3	365
Darinth Park Amy	Laureldale Trump	Mature	273	8,056	4·5	359
Darinth Park Daphne	Fernhill Searchlight	J.2	273	6,143	4·9	298
	STRACHAN, A. W., Oxley (Guernsey, 4).					
Kenilworth Marguerite	Kenilworth Commando	Mature	240	3,645	4·0	147
Maidavale Rosebud	Maidavale Golden Sovereign	Mature	273	5,043	4·2	213
Kenilworth Snow White	Glenfield Emperor	Mature	240	4,296	4·4	187
Sunny Vale Jewel	Moongi Rose Prince	J.4	180	3,351	5·1	171
	WILSON, E. A. R., Goovigen (Guernsey, 1).					
Glenfield Caress	Moongi Countess Lad	J.2	273	5,595	4·6	260
	JERSEY.					
	AHERN, J., Conondale (Jersey, 14).					
Connemara Winsome	Glenview Lochiel	Mature	273	5,836	6·2	363
Connemara Cream Maid	Glenview Lochiel	J.4	273	6,538	5·6	367
Trinity Hopeful Treasure	Trinity Crowning Effort	Mature	273	5,697	5·3	304
Lermont Bright Girl 2nd	Trinity Graceful Duke	J.2	273	4,583	5·4	249
Connemara Mistress Enid	Trecarne Democrat	J.2	273	3,442	5·6	195
Connemara Royal Chimes	Trecarne Golden King 2nd	S.4	273	4,065	6·5	264
Brooklodge Petunia	Trecarne Some Victor 4th	S.3	273	5,831	5·5	322
Brooklodge Olive	Treacrne Some Victor 4th	S.3	273	4,908	4·6	231
Connemara Cream Lass	Belgonia Flashlight	J.2	273	4,255	5·5	235
Connemara Countess Emily	Belgonia Flashlight	J.2	273	5,345	5·4	288
Connemara Choice Orchid	Belgonia Flashlight	J.2	273	4,695	5·3	247
Connemara Rosella	Belgonia Flashlight	J.3	273	4,145	5·1	212
Brooklodge Ada	Trinity Mighty Prince	S.4	273	5,952	5·8	343
Brooklodge Mayday	Trinity Mighty Prince	S.3	273	6,168	5·1	316
Brooklodge Darkie	Trinity Mighty Prince	J.3	210	3,219	5·4	174

ANDERSON, R. A., Yandina (Jersey, 5).						
Bonnie Brae Flavia	Bonnie Bray Darby	Mature	240	3,963	4·0	158
Bonnie Brae Fleur	Bonnie Brae Darby	J.4	273	3,454	5·1	175
Bonnie Brae Sultane's Sweetie	Bonnie Brae Darby	S.3	273	4,134	4·7	193
Bonnie Brae Sultane's Treasure	Bonnie Brae Dainty Boy	Mature	273	3,759	6·1	228
Bonnie Brae Gloria	Burnleigh Royal	S.2	150	1,422	4·6	65
BAILEY, W., Biloela (Jersey, 6).						
Carnation Charmaine	Bellgarth Victory	S.3	273	6,042	5·0	305
Kingsford Zeita 2nd	Oxford Topher	J.3	273	6,455	4·2	274
Glenview Majesty	Trinity Exchange	Mature	273	8,434	4·4	369
Ashendon May	Brookland Caddy	J.2	273	5,525	4·2	234
Valhalla Mermaid 3rd	Bulby Lucky Sirius	J.2	273	5,903	4·7	276
Golden Hill Princess May's Aster	Golden Hill Joker	Mature	210	5,328	4·2	224
BARLOW, C. W. AND E. M., Acland (Jersey, 15).						
Erceldene Regina	Gem Amber	J.2	305	7,123	5·2	376
Erceldene Elaine	Gem Amber	J.2	305	4,924	5·9	293
Erceldene Loretta	Gem Amber	J.2	273	4,581	5·4	249
Erceldene Golden Girl	Gem Amber	J.2	273	4,794	5·3	256
Erceldene Golden Girl	Gem Amber	J.2	273	5,677	4·8	273
Erceldene Elaine	Gem Amber	S.2	240	4,790	5·6	268
Erceldene Regina	Gem Amber	S.2	273	7,565	5·1	385
Erceldene Regina	Gem Amber	S.2	305	8,089	5·1	413
Wyreene Daisy Belle	Wyreene Marcella's Boy	Mature	273	7,348	4·8	351
Kathleigh Fashionette 2nd	Oxford Fawn's Noble	S.4	273	6,843	5·8	395
Kathleigh Patricia 4th	Oxford Fawn's Noble	S.4	273	5,989	5·7	342
Kathleigh Silver 3rd	Oxford Fawn's Noble	S.4	273	5,801	5·4	319
Kathleigh Fashionette 3rd	Marshlands Dreamer	J.2	273	5,267	4·9	263
Kathleigh Patricia 5th	Marshlands Dreamer	J.2	273	4,998	5·8	290
Rosallen Norelle	Rosallen Majestic	J.2	273	3,782	6·5	248
Weelu Hardship's Effort	Trinity Lily's Effort	J.3	273	7,056	6·4	452
BEATTIE, G. AND V., Antigua (Jersey, 6).						
Boree Effort's Auriel	Trinity Daffodil's Effort	J.4	273	7,657	4·4	338
Boree Peer's Lustre	Boree Cute Peer	J.2	273	5,246	5·0	266
Grasmere Brittannia	Glenside Fern's Lad	S.2	273	5,323	4·5	244
Glenside Ivory	Oxford Dudley	J.4	273	5,227	5·5	291
Glenside Ellen	Navua Dreaming Bravo	Mature	273	7,996	4·3	350
Grasmere Dreaming Girl	Navua Dreaming Bravo	Mature	273	6,033	5·4	326

TABLE 12—*continued.*

RECORDS OF COWS COMPLETING LACTATION RECORDS DURING THE YEAR ENDED 30TH JUNE, 1951—*continued.*

Cow.	Sire.	Age.	Days Recorded.	Production. Milk.	Test.	Butterfat.
				Lb.	%	Lb.
	BECKINGHAM, C. H., Everton Park (Jersey, 8).					
Locherbie Silver	Oxford Rivoli Victor	Mature	273	6,346	4·7	299
Goldlands Daffodil	Calton Lotmyle	S.4	273	4,798	5·0	241
Locherbie Mischief	Oxford Daffodil's Lad	Mature	273	6,975	4·7	326
Cosme Rosslyn Gem	Gem Loyal Highness	S.2	273	5,472	5·1	278
Glenrea Melody	Brampton Bandmaster	S.4	273	6,203	5·3	332
Trecarne Jersey Miss 4th	Trecarne Some Duke	J.4	273	6,494	5·2	337
Trecarne Jersey Miss 4th	Trecarne Some Duke	S.3	273	6,287	5·0	315
Locherbie Some Maiden	Trecarne Some Duke	J.3	273	6,127	5·3	324
	BISHOP, W., Kenmore (Jersey, 8).					
Gem Serina	Englorie Cunning Victor	Mature	273	5,015	5·0	252
Gem Norelle	Gem Valour	S.4	273	6,037	5·1	311
Gem Neva	Bulby Maria's Keepsake	J.2	273	5,646	5·2	294
Gem Keeper's Ideal	Bulby Maria's Keepsake	J.2	273	5,091	5·9	302
Gem Lenora 2nd	Bulby Maria's Keepsake	S.2	240	4,578	5·8	267
Gem Marina 2nd	Bulby Maria's Keepsake	J.3	273	5,448	4·7	260
Gem Keeper's Dolly	Bulby Maria's Keepsake	J.3	150	2,937	4·4	131
Gem Celia 4th	Bulby Maria's Keepsake	S.4	273	4,574	4·5	209
	BORCHERT, Mrs. I. L. M., Kingaroy (Jersey, 5).					
Willow Bank Volly's Pet	Inverlaw Observer	S.2	273	5,306	4·8	255
Inverlaw Secret	Inverlaw Councillor	S.4	273	5,403	5·6	304
Willow Bank Coral	Brampton Daffodil's Peer	J.2	273	4,732	5·0	239
Willow Bank Audrey	Brampton Daffodil's Peer	J.2	273	3,675	5·4	201
Willow Bank Miriette	Brampton Daffodil's Peer	J.2	273	4,399	5·5	242
	BROWNE, R. J., Yangan (Jersey, 21).					
Hill 60 Golden Thread 2nd	Kelvinside Dream Boy	J.2	273	5,841	4·2	249
Hill 60 Golden Thread 2nd	Kelvinside Dream Boy	J.2	305	6,276	4·3	273
Hill 60 Golden Thread 2nd	Kelvinside Dream Boy	S.2	273	7,787	4·7	364
Hill 60 Golden Thread	Kelvinside Dream Boy	S.3	273	6,875	4·6	313
Hill 60 Likeness	Kelvinside Handsome Boy	J.2	273	5,961	4·9	295

Hill 60 Idol's Delight	Kelvinside Handsome Boy	J.2	305	[illegible]	[illegible]	[illegible]
Nairfale Sapphire	Kelvinside Handsome Boy	J.4	273	7,070	4·9	347
Nairfale Comedy's Design	Kelvinside Handsome Boy	J.4	273	4,919	5·9	293
Nairfale Chenille	Kelvinside Handsome Boy	J.4	273	7,836	5·0	391
Nairfale Chenille	Kelvinside Handsome Boy	J.4	305	8,239	4·9	408
Nairfale Coquette	Kelvinside Handsome Boy	J.4	273	6,323	5·6	357
Nairfale Coquette	Kelvinside Handsome Boy	J.4	305	6,726	5·5	375
Nairfale Coquette	Kelvinside Handsome Boy	J.4	365	7,452	5·6	422
Nairfale Idol's Delight	Nairfale Golden Recorder	Mature	273	7,389	5·6	415
Nairfale Likeness	Nairfale Golden Recorder	Mature	273	7,889	5·4	423
Nairfale Gentle	Nairfale Golden Recorder	S.4	273	7,188	5·6	406
Nairfale Gentle	Nairfale Golden Recorder	S.4	305	7,501	5·6	423
Nairfale Gentle	Nairfale Golden Recorder	S.4	365	7,830	5·6	444
Nairfale Idol's Delight	Nairfale Golden Recorder	J.4	305	7,616	6·9	441
Nairfale Lena	Nairfale Golden Reality	Mature	273	7,371	5·3	390
Minidong Maid	Balwyn Fancy's Baron	J.4	273	7,059	5·7	403
Minidong Maid	Balwyn Fancy's Baron	J.4	305	7,497	5·6	427
Nairfale Noble's Rosemary	Nairfale Pride's Noble	Mature	273	9,290	5·3	489
Nairfale Noble's Rosemary	Nairfale Pride's Noble	Mature	305	10,097	5·2	521
Nairfale Noble's Esteem	Nairfale Pride's Noble	S.2	273	7,097	6·0	432
Nairfale Noble's Esteem	Nairfale Pride's Noble	S.3	273	8,032	6·0	480
Nairfale Trinket	Nairfale Count's Prominence	Mature	273	7,090	5·3	373
Nairfale Trinket	Nairfale Count's Prominence	Mature	305	7,558	5·3	399
Glenrandle Daffodil 2nd	Trinity Gleaming Effort	J.2	305	9,226	4·8	444
Nairfale Princess Beth	Nairfale Noble Count..	Mature	273	9,887	5·1	505
Nairfale Princess Beth	Nairfale Noble Count..	Mature	305	10,686	5·1	549
Nairfale Princess Beth	Nairfale Noble Count..	Mature	365	12,019	5·2	622

BYGRAVE, P. J. L., Aspley (Jersey, 14).

Gem Carole	Lothean of Calton	Mature	273	5,927	5·0	300
Navua Beauty's Boutilliere 3rd	Navua Mighty Volunteer	Mature	273	6,977	4·9	345
Navua Beauty's Boutilliere 3rd	Navua Mighty Volunteer	Mature	273	8,382	5·0	416
Belmont Society Lady	Oxford Noble Victory	Mature	273	6,247	4·8	299
St. Joseph's Hazel 3rd	St. Joseph's High Design	Mature	273	5,602	4·7	261
Ellerdale Draconis Bess	Dreaming Cowboy (imp.)	J.2	273	5,490	4·4	242
Ellerdale Watfern Flower	Ellerdale Watfern Gamboge	J.2	273	4,794	6·0	235
Craigan Celia Empress Lace	Gem Royal Blue	J.2	273	4,874	5·3	258
Grasmere Samaritan's Belle	Navua Victorious Samaritan	J.3	273	4,354	5·6	247
Craigan Fern Aspley Belle	Navua Designing Count 2nd	J.2	210	2,727	5·5	152
Navua Cecelia's Strike 2nd	Navua Sociable Designer	J.4	273	5,912	5·4	318
Craigan Cecelia's Strike	Navua Designing Ruler	J.2	273	5,082	5·0	255
Ellerdale King's Sunbeam	Ellerdale Ruler's King	J.2	273	4,997	5·5	273
Ellerdale King's Butterfly	Ellerdale Ruler's King	J.2	273	2,947	5·1	151

TABLE 12—*continued.*

RECORDS OF COWS COMPLETING LACTATION RECORDS DURING THE YEAR ENDED 30TH JUNE, 1951—*continued.*

Cow.	Sire.	Age.	Days Recorded.	Production. Milk.	Test.	Butterfat.
				Lb.	%	Lb.
	CARPENTER, J. W., Helidon (Jersey, 1).					
Mayfair Bell 5th	Trinity Crowning Admiral	J.3	150	2,190	5·5	120
	COCHRANE, H., Kin Kin (Jersey, 22).					
Inverlaw Pet	Grasmere Brown Victory	J.2	273	2,933	5·0	149
Fauvic Sunray	Fauvic Double Up	Mature	273	3,869	4·9	193
Fauvic Remembrance	Austral Park Shiek	Mature	273	4,776	4·2	202
Fauvic Finery	Jerseyside Joan's Ruler	Mature	273	4,819	4·9	238
Fauvic Heroine	Baerami Douglas	J.3	273	4,409	5·0	220
Fauvis Suncoil	Baerami Douglas	S.4	273	3,385	5·5	187
Fauvic Recoin	Baerami Douglas	Mature	273	5,372	5·5	296
Fauvic Bouncer	Baerami Douglas	Mature	240	3,492	4·8	166
Bellamona Standard's Tidy 2nd	Bellamona Standard	J.2	240	2,490	4·2	105
Fauvic Favourite	Brooklands Big Ben	S.4	273	3,873	4·7	185
Fauvic Gleeful	Condong Marabean	Mature	273	3,900	4·6	180
Fauvic Lilac	Fauvic Cornet	J.2	273	2,271	5·3	122
Fauvic Fiddle	Fauvic Cornet	S.3	240	2,424	4·5	110
Fauvic Marpet	Fauvic Peter 2nd	S.4	273	4,398	4·8	215
Fauvic Promise	Fauvic Trial Link	J.3	273	4,245	5·9	254
Fauvic Fame	Fauvic Double Link	Mature	273	5,690	4·8	274
Fauvic Jollity	Fauvic Joker	Mature	210	3,069	4·6	140
Fauvic Check Fern	Tecoma Checker	J.2	180	1,689	4·7	79
Fauvic Check Bud	Tecoma Checker	J.2	273	3,702	4·9	180
Fauvic Fairy Ray	Condong Fairy Oxford	J.2	210	2,313	4·8	110
Fauvic Refund	Fauvic Trial Link	J.3	240	4,071	5·1	208
Fauvic Recoil	Shepstone Gallant Lad	Mature	273	6,927	5·9	410
Fauvic Recoil	Shepstone Gallant Lad	Mature	305	7,422	6·0	444

	COLVIN, J., Beechmont (Jersey, 19).					
Eumirvel Skylark	Eumirvel Taxpayer	Mature	273	6,572	4·8	316
Eumirvel Promise	Hunstrete Emperor's Volunteer	Mature	273	4,889	5·5	272
Nairfale Faithful	Nairfale Golden Recorder	Mature	273	5,004	5·4	275
Eumirvel Belinda	Oxford Brown Victor	Mature	273	6,370	5·9	376
Eumirvel Golden Answer	Reflections Golden Aim (imp.)	J.2	273	4,844	5·6	269
Eumirvel Nonette	Eumirvel Beechmont Peer	Mature	273	7,818	5·5	427
Eumirvel Mariette	Eumirvel Beechmont Peer	Mature	273	5,323	5·6	300
Eumirvel Neta	Eumirvel Beechmont Peer	Mature	273	8,193	5·2	427
Eumirvel Ringlet	Eumirvel Beechmont Peer	Mature	273	5,055	5·3	269
Eumirvel Valetta	Eumirvel Beechmont Peer	Mature	273	5,025	5·8	293
Eumirvel Star Desire	Avon Real Star (imp., N.Z.)	J.2	273	3,384	6·4	217
Eumirvel Star Pearl	Avon Real Star (imp., N.Z.)	J.2	240	4,389	5·2	231
Eumirvel Star Delight	Avon Real Star (imp., N.Z.)	J.2	273	4.033	5·1	208
Eumirvel Star Hope	Avon Real Star (imp., N.Z.)	J.2	273	5,385	4·7	255
Eumirvel Star Gem	Avon Real Star (imp., N.Z.)	J.2	273	5,233	5·2	274
Eumirvel Star Fancy	Avon Real Star (imp., N.Z.)	J.2	273	4,746	4·5	215
Eumirvel Star Lady	Avon Real Star (imp., N.Z.)	S.2	273	4,154	5·9	249
Eumirvel Star Maiden	Avon Real Star (imp., N.Z.)	S.2	273	6,435	5·2	340
Eumirvel Star Queen	Avon Real Star (imp., N.Z.)	S.3	273	5,934	5·2	310
	CONOCHIE, W. S. AND SONS, Sherwood (Jersey, 7					
Brookland Merry Prudence	Bulby Maria's Keepsake	Mature	273	7,496	5·3	400
Brookland Regal Laurel Leaf	Brookland Regalia	S.4	273	6,896	5·9	406
Brookland Regal Monica	Brookland Regalia	J.4	273	6,726	4·8	323
Brookland Regal Fleur	Brookland Regalia	S.3	273	6,059	5·6	341
Brookland Regal Oak Leaf	Brookland Regalia	J.3	273	6,278	5·5	348
Brookland Fleurette	Brookland Merry Monarch	J.2	273	4,470	6·3	282
Brookland Jovial Fay	Windsor Merry Charles	J.2	273	4,982	5·6	278
	CORNHILL, E. D. J., Dundas (Jersey, 10).					
Arranmore Beauty's Best	Arranmore Bell's Volunteer	Mature	273	5,208	4·7	246
Arranmore Sapphire 2nd	Arranmore Bell's Volunteer	S.4	240	4,113	5·3	221
Erceldene Marita	Wyreene Boutillere	S.4	273	4,849	5·6	273
Rosedene Bright Eyes	Morago Flora's Keepsake	J.3	273	4,983	4·9	245
Carnation Larkspur Toy	Carnation Toy	S.2	273	4,777	5·3	253
Lawn View Silver Socks	Oxford Sam	J.2	273	4,238	5·0	213
Rosedene Morning Glory	Lawn View Teddie	S.2	273	4,386	5·1	224
Rosedene Daisy Bell	Lawn View Teddie	J.2	273	4,376	5·1	223
Rosedene Golden Silver	Lawn View Teddie	J.2	273	5,056	4·5	227
Rosedene Model	Lawn View Teddie	J.2	150	2,265	4·3	97

TABLE 12—*continued.*

RECORDS OF COWS COMPLETING LACTATION RECORDS DURING THE YEAR ENDED 30TH JUNE, 1951—*continued.*

Cow.	Sire.	Age.	Days Recorded.	Production. Milk.	Test.	Butterfat.
				Lb.	%	Lb.
	COX, R. V. D., Maleny (Jersey, 2).					
Glengarriffe Cunning Colleen	Navua Cunning Lad	Mature	273	5,958	5·5	329
Glengarriffe Dreamer's Gipsy 3rd	Selsey Dreamer	J.3	273	4,656	6·1	286
	COX, F. J. AND SONS, Crawford (Jersey, 26).					
Rosel Mable	Rosel Solid Gold	Mature	273	5,572	4·6	261
Rosel Lady May	Rosel Solid Gold	Mature	273	5,855	5·0	293
Rosel Valmai	Rosel Solid Gold	Mature	273	4,795	4·4	212
Rosel Elsa	Rosel Solid Gold	Mature	273	8,086	5·7	459
Rosel Royal Lass	Rosel Solid Gold	Mature	273	7,281	5·0	367
Rosel Judith	Rosel Solid Gold	S.4	180	3,516	5·3	185
Rosel Dulcie	Rosel Solid Gold	S.4	273	5,118	5·6	290
Rosel Dawn	Rosel Solid Gold	S.4	273	3,738	6·9	260
Rosel Anabelle	Rosel Solid Gold	J.4	273	5,138	5·6	290
Rosel Sally	Rosel Solid Gold	J.4	240	4,323	5·4	236
Rosel Joan	Rosel Solid Gold	J.4	273	5,341	5·8	315
Rosel Dora	Rosel Solid Gold	J.3	273	4,046	6·2	254
Rosel Betty	Belmont Royal Peer	J.2	273	4,817	4·8	234
Rosel Poppy	Belmont Royal Peer	J.2	273	3,854	5·2	202
Rosel Daisy	Belmont Royal Peer	J.2	240	2,814	5·3	152
Rosel Joyce	Belmont Royal Peer	J.2	273	3,960	4·9	196
Rosel Creole	Belmont Royal Peer	J.2	273	5,185	4·2	219
Rosel Ellen's Pride	Belmont Royal Peer	J.2	273	5,774	5·3	304
Rosel Elaine	Belmont Royal Peer	J.2	273	4,070	5·5	226
Rosel Daphne	Belmont Royal Peer	J.2	273	4,177	4·9	207
Rosel Starbright	Belmont Royal Peer	J.2	273	3,948	5·1	205
Rosel Annette	Belmont Royal Peer	J.2	273	3,407	4·8	166
Rosel Bonnie	Belmont Royal Peer	J.2	273	4,684	4·6	216
Rosel June	Belmont Royal Peer	J.2	273	3,903	5·3	209
Rosel Dainty	Belmont Royal Peer	J.2	120	2,436	5·3	131
Rosel Beryl	Belmont Royal Peer	J.2	273	3,776	5·3	203

CRAMB, S. A., Caboolture (Jersey, 6).						
Fauvic Dazzling	Austral Park Shiek	Mature	273	5,459	4·3	236
Fauvic Subway	Austral Park Distinction	S.2	273	5,944	5·2	311
Fauvic Subway	Austral Park Distinction	S.2	305	6,431	5·3	338
Caergwrle Tulip	Inverlaw Bandmaster	J.2	273	5,963	5·2	313
Caergwrle Tulip	Inverlaw Bandamster	J.2	305	6,584	5·2	349
Fauvic Daydawn	Fauvic Cornet	J.2	273	7,194	4·7	340
Fauvic Daydawn	Fauvic Cornet	J.2	305	7,774	4·8	377
Fauvic Daydawn	Fauvic Cornet	J.2	365	8,557	4·9	422
Fauvic Welcome	Lindenfels Jester's Priceless	S.2	273	5,788	5·0	292
Fauvic Welcome	Lindenfels Jester's Priceless	S.2	305	6,182	5·1	316
Amaroo Golden Lady	Glengarriffe Caesar's Deemster	J.2	273	5,249	5·5	291
Amaroo Golden Lady	Glengarriffe Caesar's Deemster	J.2	305	5,632	5·7	319
FARM HOME FOR BOYS, Westbrook (Jersey,9).						
Westbrook Starbright 16th	Westbrook Comet 26th	J.2	273	4,080	4·8	196
Westbrook Golden Bread 11th	Westbrook Comet 26th	J.2	273	6,202	5·2	323
Westbrook Sylvia 29th	Westbrook Comet 26th	S.2	273	6,119	4·6	282
Westbrook Bells 20th	Westbrook Comet 26th	S.2	273	4,054	5·3	216
Westbrook Starbright 17th	Wyalla Golden Lad	J.2	273	4,467	5·5	246
Westbrook Tulip 154th	Westbrook Silvermine's Valour	J.2	273	5,349	4·1	222
Westbrook Tot	Westbrook Silvermine's Valour	S.2	273	4,828	4·8	234
Westbrook Sylvia 28th	Westbrook Silvermine's Valour	J.3	273	4,993	4·7	239
Westbrook Sylvia 31st	Mornmoot Clementine's Valour	J.2	273	5,639	4·8	271
GRANGER BROS., Lockyer (Jersey, 14).						
Trecarne Dairy Queen 3rd	Trecarne Some Duke	Mature	273	6,491	5·2	338
Trecarne Jersey Queen 8th	Trecarne Some Duke	Mature	273	7,967	5·9	469
Trecarne Golden Tot 4th	Trecarne Some Duke	Mature	273	6,704	5·3	359
Trecarne Some Eileen	Trecarne Some Duke	Mature	273	7,449	4·7	352
Trecarne Doreen 7th	Trecarne Some Duke	S.3	273	6,827	4·8	330
Oxford Corinne	Glenview Royal Chief	J.4	273	8,030	4·8	383
Glenrea Seaflower	Oxford Dark Victor	Mature	273	6,632	6·3	417
Trecarne Golden Dairy Girl 2nd	Brampton Daffodil's Peer	Mature	273	7,955	5·4	429
Trecarne Ryebread 5th	Trecarne Golden Lad 2nd	J.2	273	4,848	5·1	248
Trecarne Dairy Queen 5th	Trecarne Golden Lad 2nd	J.2	273	5,218	6·0	311
Treacrne Bright Queen 2nd	Trecarne Golden Lad 2nd	J.2	273	5,148	5·2	266
Trecarne Golden Jersey Lass	Trecarne Golden Lad 2nd	S.2	273	7,339	5·0	367
Trecarne Dairymaid's Hope	Trecarne Golden Lad 2nd	S.3	273	6,690	5·2	346
Trecarne Jersey Queen 9th	Treacrne Golden Lad 2nd	J.4	273	7,976	6·2	491

TABLE 12—*continued.*

RECORDS OF COWS COMPLETING LACTATION RECORDS DURING THE YEAR ENDED 30TH JUNE, 1951—*continued.*

Cow.	Sire.	Age.	Days Recorded.	Production. Milk.	Test.	Butterfat.
				Lb.	%	Lb.
GRASMERE JERSEY STUD, Neurum (Jersey, 13).						
Grasmere Dove's Lily	Grasmere Elaine's Victory	J.2	273	4,430	5·8	257
Grasmere Golden Ivy	Oakleigh Golden Pride (imp., N.Z.)	J.2	210	3,102	6·7	175
Grasmere Victory's Sarah	Oxford Brown Victory	Mature	240	4,409	4·9	219
Grasmere Noble Star	Springhurst Noble Oak	Mature	210	4,356	5·4	238
Glenview Golden Elbis	Trinity Governor's Hope	Mature	273	4,918	5·7	280
Grasmere Twinkle's Gloria	Grasmere Twinkle's Victory	S.3	273	5,007	5·4	268
Grasmere Twinkle's Vanity	Grasmere Twinkle's Victory	J.2	150	1,824	5·7	104
Grasmere Lynn's Sultane	Grasmere Lady Lynn's Victory	S.2	240	4,233	5·6	235
Carnation Lassie Belle	Riveria Royal Sovereign	S.2	240	3,255	5·9	194
Trecarne Hopeful 2nd	Trecarne Golden Lad 2nd	J.3	180	3,843	5·4	209
Benvue Daffodil	Navua Victory's Elf	J.2	273	3,825	4·7	178
Bremerside Lola	Trinity Handsome Duke	Mature	150	2,181	5·7	126
Trecarne Daffodil 3rd	Trecarne Ruler 2nd	Mature	273	6,479	5·5	355
GREGORY, P. H., Rosevale (Jersey, 2).						
Windsor Royal Rose	Brookland Merry Monarch	J.2	273	4,410	5·5	245
Windsor Regal Romance	Brookland Lord Roseberry	J.2	273	4,799	5·1	244
HARLEY, G., Kingaroy (Jersey, 2).						
Hopewell Blue's Daffodil	Trinity Daffodil's Design	Mature	273	7,179	4·3	304
Hopewell Desley 2nd	Trinity Daffodil's Design	S.2	273	4,333	5·0	221
HUEY, C., Sabine (Jersey, 16).						
Ashview Lady 2nd	Trecarne Victor 4th	Mature	273	6,991	5·7	400
Ashview Lady 3rd	Trecarne Victor 4th	Mature	273	8,415	5·7	481
Ashview Gift	Trecarne Victor 4th	J.4	273	6,508	5·0	326
Ashview Larkspur 2nd	Trecarne Victor 4th	S.2	273	5,721	5·1	293
Ashview Ladyette 3rd	Trecarne Some Tot's Duke 2nd	J.2	273	3,257	5·9	195
Ashview Mischief 2nd	Trecarne Some Tot's Duke 2nd	J.2	273	4,490	5·4	246
Ashview Mossrose	Trecarne Some Tot's Duke 2nd	J.2	273	6,928	4·9	340

Ashview Some Lady 3rd	Trecarne Some Tot's Duke 2nd					
Ashview Locket 5th	Trecarne Some Tot's Duke 2nd	J.2	273	3,153	6·2	196
Ashview Ladyette 2nd	Trecarne Some Tot's Duke 2nd	S.2	273	6,473	5·1	333
Ashview Marvel 2nd	Trecarne Some Tot's Duke 2nd	S.2	273	4,288	5·6	240
Ashview Some Lady 2nd	Trecarne Some Tot's Duke 2nd	J.3	273	6,832	5·2	357
Ashview Hazeldale	Trecarne Some Tot's Duke 2nd	S.3	273	5,047	5·7	291
Ashview Ladyette	Trecarne Some Tot's Duke 2nd	J.4	273	7,061	5·4	379
Ashview Lady Lynn	Parrabel Oxford Thorn	J.2	273	4,932	5·5	273
Rosallen Mary 2nd	Brooklands Regal Soveriegn	J.2	273	5,211	5·4	280
	JOHNSON, H. G., Gleneagle (Jersey, 6.)					
Windsor Royal Ann	Brookland Lord Roseberry	J.2	240	4,934	5·1	252
Windsor Princess Irene	Bobs of Wingate	Mature	273	8,231	5·4	449
Windsor Royal Constance	Brookland Merry Monarch	J.2	273	5,517	4·7	261
Windsor Royal Denise	Brookland Merry Monarch	J.2	273	5,462	4·7	259
Windsor Royal Margaret	Brookland Merry Monarch	J.2	273	5,902	4·8	285
Windsor Royal Ruth	Brookland Merry Monarch	S.2	273	7,335	5·6	414
	JOHNSTON, R. D., Kingaroy (Jersey, 26).					
Mannuem Maidie	Nim-Brae Promotor	Mature	273	7,406	5·3	395
Mannuem Mabel	Nim-Brae Promotor	Mature	273	5,876	4·9	290
Mannuem Morilla	Nim-Brae Promotor	Mature	273	6,249	5·0	311
Gunawah Cluster	Gunawah Oxford Royal	J.2	273	6,000	4·5	273
Mannuem Cosmos 3rd	Gunawah Robin Hood	J.2	273	3,324	5·6	187
Mannuem Fern	Gunawah Robin Hood	J.2	273	5,309	5·2	276
Mannuem Marguerite	Gunawah Robin Hood	S.2	273	6,580	4·9	324
Mannuem Cosmos 3rd	Gunawah Robin Hood	J.3	273	4,674	5·6	259
Mannuem Blue Morilla	Tecoma Blue Boy	J.2	273	4,421	5·7	251
Mannuem Blue Cosmos 2nd	Tecoma Blue Boy	J.2	273	3,494	5·2	181
Mannuem Blue Dolphin	Tecoma Blue Boy	J.2	273	3,954	5·2	208
Mannuem Mist	Tecoma Blue Boy	J.2	273	2,899	5·4	159
Mannuem Paxie	Tecoma Blue Boy	J.2	273	4,237	5·2	222
Mannuem Blue Maud	Tecoma Blue Boy	J.2	273	4,912	5·4	264
Mannuem Blue Cosma	Tecoma Blue Boy	J.2	273	4,259	5·6	240
Mannuem Fern 2nd	Tecoma Blue Boy	J.2	273	5,348	5·1	275
Strathdean Charm 2nd	Trinity Crowning Noble	J.2	273	4,543	5·3	241
Keystone Masquerade	Keystone Neptune 2nd	Mature	273	4,931	5·3	264
Gunawah Bluecap	Gunawah True Blue	J.2	273	4,434	4·7	210
Oxford Floradora	Oxford King Peter	J.2	273	4,278	4·8	208
Inverlaw Dark Petal	Oxford Royal Lad	S.3	273	5,930	5·2	311
Gunawah Suzelle	Austral Park Montrose Blue	J.3	273	6,274	5·0	313
Gunawah Marguerite	Gunawah Jack Frost	Mature	273	6,548	4·3	283
Gunawah Tulip	Gunawah Jack Frost	Mature	273	6,798	4·8	323
Keystone Morilla 14th	Bonnie Vue Gay Peer	Mature	273	6,667	4·3	285
Mannuem Dulcie 2nd	Kathleigh Bunty's King	J.3	240	4,344	5·5	239

TABLE 12—*continued.*

RECORDS OF COWS COMPLETING LACTATION RECORDS DURING THE YEAR ENDED 30TH JUNE, 1951—*continued.*

Cow.	Sire.	Age.	Days Recorded.	Production. Milk.	Test.	Butterfat.
				Lb.	%	Lb.
KEEN, C. J., Mulgeldie (Jersey, 9).						
Kathleigh Dreamer's Sylvale	Marshlands Dreamer	J.2	273	5,280	4·4	234
Green Valley Moderate	Keystone Moderator	S.2	273	4,524	5·7	260
Glenside Ellen 2nd	Oxford Dudley	S.3	273	7,970	5·0	396
Grasmere Samaritan's Faith	Navua Victorious Samaritan	J.3	180	3,327	4·8	162
Grasmere Dreaming Sheila	Nauva Dreaming Bravo	S.3	273	6,728	4·3	292
Boree Cute Charm	Trinity Cute Commodore	Mature	273	6,896	4·9	342
Hazeldean Anita	Glenview Thorn	S.2	273	5,849	3·9	233
Green Valley Belle	Glenview Thorn	J.2	273	4,783	5·0	239
Green Valley Wattlebloom	Glenview Thorn	J.2	273	4,508	5·0	227
KERLIN, P., Killarney (Jersey, 24).						
Bellgarth Bertha 3rd	Trecarne Renown 2nd	Mature	273	7,971	5·2	417
Glenrandle Tiny	Bellgarth Glory King 2nd	Mature	273	6,605	5·9	393
Glenrandle Lucy	Bellgarth Glory King 2nd	Mature	273	6,639	5·6	373
Bellgarth Nicety	Jersey Park Royal Supreme	J.2	273	4,812	5·2	254
Glenrandle Gleaming Maid	Trinity Gleaming Effort	J.2	273	4,526	5·2	239
Glenrandle Cream Maid	Trinity Gleaming Effort	J.2	273	5,676	5·2	296
Glenrandle Goldenette 2nd	Trinity Gleaming Effort	J.2	273	5,785	5·5	320
Glenrandle Charm	Trinity Gleaming Effort	J.2	240	3,978	5·6	224
Glenrandle Daffodil 2nd	Trinity Gleaming Effort	J.2	273	8,384	4·7	398
Glenrandle Viola	Bellgarth Victory	J.2	273	5,217	5·6	297
Glenrandle Lulu	Oxford Noble Peer	Mature	273	8,001	6·0	484
Glenrandle Spotted Lady	Oxford Noble Peer	Mature	273	6,015	5·6	334
Glenrandle Handsome Lady	Bellgarth Stylish	Mature	273	9,406	5·6	534
Glenrandle Luna	Bellgarth Stylish	Mature	273	7,124	5·7	409
Glenrandle Golden Girl	Bellgarth Stylish	Mature	273	6,800	5·7	392
Glenrandle Hazeldale	Bellgarth Stylish	Mature	273	6,304	5·6	355
Glenrandle Fashion Lady	Bellgarth Stylish	Matiure	273	6,146	5·3	327
Glenrandle Pretty Lady	Gem Rodney	J.2	273	6,500	4·7	309
Glenrandle Diana	Gem Rodney	S.2	273	5,993	5·2	315
Glenrandle Evenbelle 2nd	Gem Rodney	S.2	273	5,780	5·2	304
Glenrandle Lotus Lily 2nd	Gem Rodney	S.2	273	5,663	5·1	292
Glenrandle Fair Lassie 2nd	Gem Rodney	J.3	273	5,600	6·4	360
Glenrandle Joan	Gem Rodney	J.3	273	6,219	5·7	357
Glenrandle Winsome Lady	Gem Rodney	J.3	273	5,837	6·6	389

	KIRBY, W. S., Tinana (Jersey, 1).					
Broadview Crowning Beauty	Trinity Irondele's Effort	J.2	273	4,048	5·0	203
	LESCHKE, F. C., Wanora (Jersey, 4).					
Delrose Betty	Oxford Erin's Victor	S.3	273	6,159	5·1	313
Delrose Dell	Oxford Erin's Victor	S.3	273	5,810	5·3	311
Delrose Fay	Oxford Erin's Victor	J.3	273	6,061	5·4	329
Oxford Jan	Oxford Franklyn	J.2	273	5,414	5·1	279
	LOUTTIT, D. J., Mulgeldie (Jersey, 5).					
Upwell Shropshire Lassie	Glenview Some Sultan	J.2	273	5,358	5·6	301
Inverlaw Rosel	Inverlaw Mistral	J.2	273	3,428	5·9	202
Grasmere Meadowsweet 2nd	Grasmere Watfern's Victory	J.2	273	5,430	5·1	279
Boree Effort's Lynette	Trinity Daffodil's Effort	S.3	273	7,798	5·1	401
Grasmere Nôn Pariel's Pride	Oaklea Golden Pride (imp.)	S.2	273	4,497	5·5	249
	LOVELL, J. F. and H. A., Samford (Jersey, 6).					
Tarana Lady Bru-Lynne	Oxford Bruno	J.2	273	4,337	5·6	243
Tarana Sweet Rosalee	Oxford Bruno	J.3	273	4,802	5·5	263
Golden View Tiny	Golden View Hero	J.3	273	4,542	5·6	255
Glenbrook Lady Lynn	Glenbrook Governor	Mature	273	6,370	4·4	283
Tarana Astley	Lermont Golden Victory	S.4	273	6,610	5·0	333
Glenbrook Rose Nella 2nd	Lermont Golden Victory	Mature	273	6,141	5·1	317
	LYNCH, A. P. and S. A., Mundubbera (Jersey, 3).					
Boree Effort's Lucy	Trinity Daffodil's Effort	J.2	273	6,150	5·6	345
Boree Effort's Bubbles	Trinity Daffodil's Effort	J.4	273	7,985	4·8	385
Boree Effort's Curly	Trinity Daffodil's Effort	J.4	273	10,022	4·2	418
	MARSDEN, L. E., Canaga (Jersey, 7).					
Woodview Merrybells	Trecarne Royal Officer	J.3	273	5,690	5·5	317
Woodview Lime	Woodview Officer	S.3	273	6,712	5·7	384
Woodview Love Bird	Brookland Royal Regalia	J.2	273	7,616	4·9	375
Fernflat Butterfly	Woodview Bosker	J.2	273	4,719	5·0	237
Glenrea Seaspray 3rd	Trecarne Some Duke	J.2	273	5,027	4·9	244
Trecarne Some Dairymaid 5th	Trecarne Golden Lad 2nd	J.2	273	5,200	5·2	270
Ashview Primrose	Ashview Double Duke	J.2	210	2,318	6·9	160

TABLE 12—*continued.*

RECORDS OF COWS COMPLETING LACTATION RECORDS DURING THE YEAR ENDED 30TH JUNE, 1951—*continued.*

Cow.	Sire.	Age.	Days Recorded.	Production. Milk.	Test.	Butterfat.
				Lb.	%	Lb.
MATTHEWS, E. A., Yarraman (Jersey, 10).						
Oakvale Lady	Glenview Exchange	Mature	273	7,938	5·0	398
Yarradale Rosy	Inverlaw White Flash	Mature	273	5,225	5·5	289
Sunnyside Elsa 3rd	Sunnyside Banjo	J.4	273	5,628	5·5	314
Oakvale Millet	Oakvale Victor	Mature	180	2,811	4·2	120
Inverlaw Wild Flower	Carnation Lassie's Peer	Mature	273	4,967	5·6	282
Inverlaw White Hope	Inverlaw Councillor	J.3	273	4,437	5·8	256
Yarradale Petal	Smythesdale Bruce	S.3	273	6,392	4·7	303
Yarradale Gold Dust	Smythesdale Bruce	S.2	273	4,501	4·7	215
Yarradale Rosina	Smythesdale Bruce	S.2	273	3,606	5·1	184
Yarradale Pretty Flower	Smythesdale Bruce	J.2	180	2,142	4·9	105
MAY, Miss M., Hermitage (Jersey, 7).						
Englebourne Daffodil	Englebourne Gem's Remus	J.2	273	2,993	5·2	158
Englebourne Melba	Englebourne Gem's Remus	J.2	273	3,087	4·5	139
Englebourne Trixie	Englebourne Gem's Remus	J.2	273	4,120	5·2	215
Englebourne Remus Samaritaine	Englebourne Gem's Remus	J.2	273	4,781	5·6	270
Englebourne Butterfly	Englebourne Gem's Remus	J.3	273	6,130	5·3	323
Englebourne Peggy	Oxford Floss's Remus	Mature	273	6,119	5·2	322
Grasmere Majestic Pride	Oaklea Golden Pride (imp., N.Z.)	J.2	273	3,099	4·3	136
McCARTHY, J. S., Greenmount (Jersey, 14).						
Trinity Crowning Rose	Trinity Crowning Effort	J.2	273	5,104	5·7	293
Trinity Sweet Crescent	Trinity Crowning Effort	J.2	273	5,683	5·1	295
Trinity National May 2nd	Trinity National Victory	J.2	273	3,902	5·0	196
Glen Erin Model	Trinity Margaret's Effort	J.2	273	6,449	4·9	317
Glen Erin Model	Trinity Margaret's Effort	J.2	305	6,924	5·0	344
Glen Erin Madiera 2nd	Trinity Cute Monarch	J.2	273	4,752	5·4	259
Glen Erin Lady Graceful	Trinity Cute Monarch	J.2	273	6,250	5·2	326
Glen Erin Lady Graceful	Trinity Cute Monarch	J.2	305	6,650	5·3	352
Glen Erin Tulip	Trinity Cute Monarch	J.2	273	7,155	5·0	355
Kathleigh Laguna	Marshlands Dreamer (imp.)	J.2	273	4,962	4·9	244
Ellerdale Watfern Berenice	Ellerdale Watfern Gamboge	S.2	273	6,326	6·0	385
Glen Erin Royal Wedding	Westbrook Valour 29th	J.2	273	4,303	5·2	228

Kathleigh Bronze Wing	Kathleigh Madrid	J.2	273	4,470	5·7	257
Glen Erin Princess 2nd	Ashfield Prometheus	S.2	273	7,396	5·3	388
Trecarne Jersey Maiden 3rd	Trecarne Some Duke	S.4	273	7,589	5·4	408
Glen Erin Daffodil	Trinity Margaret's Effort	J.2	273	5,173	5·5	288
MEIER, L. E., Boonah (Jersey, 10).						
Oxford Highlady 4th	Oxford King Peter	J.2	273	4,928	5·9	295
Oxford Butterfly	Oxford King Peter	J.2	273	4,226	5·5	233
Oxford Fillette	Oxford King Peter	J.3	210	3,651	4·9	177
Oxford Goldflake	Oxford Noble Winston	J.2	240	3,660	5·4	198
Kingsford Betty 2nd	Oxford Topher	Mature	273	6,983	5·0	354
Ellerdale Cute's Rosy	Richmond Cute Boy	J.3	273	5,705	5·4	308
Ardath Betesco	Kingsford Some Hope	J.4	273	5,291	4·7	250
Ardath Angeline	Grasmere Tinklebell's Pride	J.2	273	4,810	4·5	218
Ardath Tinklebelle	Grasmere Tinklebell's Pride	J.2	273	4,337	4·7	203
Ardath Penelope	Grasmere Tinklebell's Pride	J.2	273	3,815	4·7	181
NEWTON, E. C., Upper Caboolture (Jersey, 7).						
Grasmere Pioneer's Hazel	Grasmere Anemones Pioneer	J.3	273	5,273	5·1	274
Boree Tulip's Maid	Trinity Daffodil's Effort	J.2	273	4,885	4·5	222
Boree Peeress's Pride	Trinity Daffodil's Effort	J.2	273	4,820	4·7	227
Malvern Freda	Grasmere Gambogia's Royal	J.2	273	3,912	5·4	214
Malvern Royal Joan 2nd	Grasmere Gambogia's Royal	J.2	273	4,299	5·4	235
Malvern Royal Tulip	Grasmere Gambogia's Royal	S.2	273	4,725	6·0	284
Malvern Royal Lady	Grasmere Gambogia's Royal	S.2	273	4,109	5·5	225
PORTER, F., Cambroon (Jersey, 16).						
Westwood Snow Queen	Westwood Royal Decree	J.2	273	4,241	5·5	236
Westwood Sky Rocks	Westwood Silver Standard	J.2	273	5,515	6·3	350
Westwood Bell Bird	Trecarne Golden King 2nd	S.4	273	6,245	6·8	425
Westwood Sun Flash	Belgonia Flashlight	J.2	273	4,792	6·8	328
Westwood Gold Crest	Belgonia Flashlight	J.2	273	5,415	5·5	300
Westwood Susan	Westwood Lotus King	J.2	273	3,643	5·5	203
Westwood Letitia	Westwood Lotus King	J.2	273	4,679	6·6	308
Westwood Silver Bells 2nd	Devon Park Madeira's Victorious	J.2	273	5,217	6·4	335
Westwood Crystal Step	Devon Park Madeira's Victorious	J.2	273	5,104	5·7	291
Westwood Star Gold 2nd	Devon Park Madeira'a Victorious	J.2	273	4,994	5·5	276
Westwood Marvel	Devon Park Madeira's Victorious	S.2	273	5,632	6·3	357
Westwood Fairyfly	Devon Park Madeira's Victorious	S.2	273	5,010	6·1	305
Westwood Pauline	Devon Park Madeira's Victorious	S.2	273	4,293	5·4	231
Westwood Sunspot	Devon Park Madeira's Victorious	S.3	273	6,376	6·4	406
Westwood Columbine	Devon Park Madeira's Victorious	S.3	273	6,274	6·8	426
Westwood Golden Daffodil	Devon Park Madeira's Victorious	S.3	273	7,540	6·1	461

TABLE 12—*continued.*

RECORDS OF COWS COMPLETING LACTATION RECORDS DURING THE YEAR ENDED 30TH JUNE, 1951—*continued.*

Cow.	Sire.	Age.	Days Recorded.	Production. Milk.	Test.	Butterfat.
				Lb.	%	Lb.
Q.A.H.S. and College, Lawes (Jersey, 14).						
Oxford Skylark	Oxford Franklyn	J.2	273	5,252	4·9	258
Oxford Janina	Oxford Franklyn	S.2	273	7,554	4·1	317
Oxford Sonia	Oxford Franklyn	S.2	273	4,201	4·8	204
Oxford Collette	Oxford King Peter	S.2	273	4,742	5·7	272
College Mistletoe 3rd	College Ambassador	J.2	273	4,341	4·8	210
College Tulip 8th	Westbrook Ambassador 52nd	S.2	273	6,196	4·6	289
Glenside Rhonda	Oxford Dudley	J.3	273	4,984	5·2	261
Grasmere Samaritan's Freida	Navua Victorious Samaritan	S.3	273	6,256	5·9	370
Grasmere Samaritan's Majesty	Navua Victorious Samaritan	S.2	210	3,465	5·1	179
Carnation Toy's Cream Girl	Carnation Toy	J.2	210	2,633	4·5	120
Grasmere Twinkle's Rochette	Grasmere Twinkle's Victory	J.2	240	3,714	5·2	194
Carnation Princess June	Oxford Fawn's Victor	S.4	273	6,560	4·7	310
Carnation Felicity	Oxford Fawn's Victor	J.4	273	6,650	4·8	321
Carnation Cream Girl	Oxford Fawn's Victor	J.4	273	5,882	5·3	309
RALPH, G. H., Ravensbourne (Jersey, 6).						
Ashview Hopeful 2nd	Trecarne Some Tot's Duke 2nd	S.2	273	5,190	5·7	298
Silverbrook Joyful 2nd	Trinity Noble Effort	S.2	273	5,067	6·2	314
Silverbrook Shamrock 2nd	Trinity Noble Effort	S.2	273	5,707	4·9	279
Silverbrook Primrose 2nd	Trinity Noble Effort	J.3	273	6,267	5·1	320
Ashview Fairy	Ashview Eva's Victor 3rd	J.2	273	3,805	4·7	180
Ashview Opal	Parrabel Oxford Thorn	J.2	273	4,436	5·0	222
ROSE, A. and E. R., Gayndah (Jersey, 7).						
Boree Gift's Marvel	Maurfield Larkspur's Gift	Mature	273	7,938	4·5	358
Boree Effort's Crystal	Trinity Daffodil's Effort	J.2	273	5,333	5·1	271
Boree Effort's Daffodil	Trinity Daffodil's Effort	J.2	273	5,600	4·8	270
Boree Effort's Cupid	Trinity Daffodil's Effort	J.2	273	4,317	4·8	206
Boree Effort's Candy	Trinity Daffodil's Effort	J.2	273	5,144	4·9	254
Boree Effort's Petal	Trinity Daffodil's Effort	J.2	273	5,509	4·7	279
Boree Effort's Primrose	Trinity Daffodil's Effort	J.2	273	6,945	4·6	323

SEMGREEN, A. L., Coolabunia (Jersey, 35).

Tecoma Madam	Tecoma Prince Clair	Mature	365	9,083	5·6	513
Austral Park Coronation Cowslip	Austral Park Coronation Oxford	Mature	365	12,001	5·4	653
Austral Park Nonsense	Austral Park Nice Lad	Mature	273	7,071	5·2	381
Austral Park Nonsense	Austral Park Nice Lad	Mature	365	8,590	5·4	467
Tecoma Prissie	Glenview Royal Chief	S.3	273	6,107	5·8	359
Tecoma Averiel	Glenview Royal Chief	J.4	273	6,684	5·6	377
Tecoma Rosette	Glenview Royal Chief	J.4	273	7,517	5·3	400
Tecoma Rosette	Glenview Royal Chief	J.4	305	8,082	5·3	432
Tecoma Woodbine	Glenview Royal Chief	S.4	273	5,398	5·3	288
Tecoma Golden Locket	Trinity Golden Royal	Mature	273	5,783	5·3	310
Tecoma Astra	Trinity Golden Royal	Mature	273	5,459	5·4	295
Tecoma Emerald	Trinity Golden Royal	Mature	240	4,497	5·5	252
Tecoma Royal Pet	Trinity Golden Royal	Mature	273	5,983	5·7	344
Tecoma Fairy Dove	Trinity Golden Royal	Mature	273	8,461	4·8	407
Tecoma Golden Darling	Trinity Golden Royal	Mature	273	10,464	5·7	601
Tecoma Golden Darling	Trinity Golden Royal	Mature	305	11,078	5·8	640
Tecoma Brown Lassie	Trinity Golden Royal	S.4	273	7,112	5·0	358
Tecoma Golden Princess	Trinity Golden Royal	S.3	273	8,610	5·2	452
Tecoma Primrose	Trinity Golden Royal	S.2	273	4,865	6·0	294
Tecoma Royal Cowslip	Trinity Golden Royal	J.2	273	6,557	5·0	325
Tecoma Royal Cowslip	Trinity Golden Royal	J.2	305	6,955	5·0	346
Tecoma Honeysuckle	Trinity Golden Royal	J.2	240	3,006	5·0	152
Tecoma Dream Girl	Trinity Golden Royal	S.2	273	4,247	5·6	239
Tecoma Golden Columbine	Trinity Golden Royal	S.2	273	5,328	5·7	307
Tecoma Florian Pet	Trinity Golden Royal	J.2	273	4,374	5·3	234
Tecoma Lady	Tecoma Florian	S.2	273	6,217	5·5	341
Tecoma Bright Darling	Inverlaw White Baron	Mature	273	7,034	5·5	388
Tecoma Bright Darling	Trinity Royal Sovereign	Mature	365	8,576	5·5	474
Tecoma Petal Lass	Trinity Royal Sovereign	J.4	273	5,503	5·6	310
Tecoma Junette's Columbine	Tecoma Golden Lad	Mature	273	8,071	5·4	438
Tecoma Junette's Columbine	Retford Juno's Noble	Mature	305	8,658	5·4	475
Tecoma Junette's Columbine	Retford Juno's Noble	Mature	365	9,260	5·6	516
Tecoma Fairy Tale	Retford Juno's Noble	J.2	273	5,874	4·3	253
Tecoma Blue Print	Austral Park Double Blue	J.2	273	5,186	5·7	294
Tecoma Blue Darling	Austral Park Double Blue	J.2	273	4,055	4·8	193
Tecoma Brown Lady	Austral Park Double Blue	J.2	273	4,634	5·8	269
Tecoma Blue Petal	Austral Park Double Blue	J.2	273	5,008	5·4	270
Tecoma Blue Wren	Austral Park Double Blue	J.2	273	4,617	5·5	254
Tecoma Arabula Pet	Austral Park Double Blue	J.2	273	5,009	5·3	266
Tecoma Blue Dove	Austral Park Double Blue	J.2	273	4,908	5·1	252
Tecoma Blue Lady	Austral Park Double Blue	S.2	273	5,027	5·7	289
Tecoma Blue Pet	Austral Park Double Blue	J.4	180	4,124	6·0	249

TABLE 12—*continued.*

RECORD OF COWS COMPLETING LACTATION RECORDS DURING THE YEAR ENDED 30TH JUNE, 1951—*continued.*

Cow.	Sire.	Age.	Days Recorded.	Production. Milk. Lb.	Test. %	Butterfat. Lb.
SIGLEY, H., Jaggan (Jersey, 13).						
Myrtledale Designing Queen	Aston Designing Effort	J.2	273	4,620	5·6	260
Myrtledale Sea Breeze	Aston Designing Effort	J.2	273	4,196	6·1	257
Myrtledale Designing Starie	Aston Designing Effort	J.2	273	4,405	5·7	251
Trinity Hopeful Blonde 2nd	Trinity Crowning Effort	J.2	273	3,743	6·0	226
Trinity Dark Hazel	Trinity Crowning Effort	J.2	273	4,477	5·9	268
Trinity Woodlark	Trinity Crowning Effort	J.2	273	3,409	6·8	233
Trinity Golden Flower 2nd	Trinity National Victory	J.2	273	4,561	4·6	212
Inverlaw Dainty Lottie	Inverlaw Councillor	S.4	273	6,144	6·1	373
Myrtledale Silvermine	Oxford Remus Count	Mature	273	6,788	5·4	372
Palmridges Fairy Gold	Palmridges Golden Lad	Mature	273	8,427	5·7	488
Myrtledale Doreen	Palmridges Golden Victory	J.3	273	6,466	6·3	414
Myrtledale Hopeful	Palmridges Golden Victory	J.2	273	5,025	5·5	275
Palmridges Mayfern	Palmridges Combination	J.3	273	4,765	5·0	239
SPRESSER, W. AND SONS, Rosewood (Jersey, 10).						
Carnation Hopeful 4th	Oxford Noble Peer	Mature	273	5,955	5·4	323
Carnation Buttergirl	Vinchelz Golden Victory	Mature	273	4,410	5·3	236
Carnation Designer's Orange	Bellgarth Designer	Mature	273	5,745	4·4	256
Carnation Peeress	Oxford Fawn's Victor	S.3	273	5,260	4·9	259
Carnation Fawn	Oxford Fawn's Victor	S.2	273	5,625	5·0	282
Carnation Faith	Oxford Fawn's Victor	S.2	240	3,291	4·5	149
Carnation Florette	Oxford Fawn's Victor	J.2	273	4,061	4·6	191
Carnation Crystal	Trinity Gleaming Effort	J.2	273	5,290	4·9	261
Carnation Fairy Princess	Trinity General Effort	J.2	273	3,738	4·4	167
Carnation Delight	Trinity General Effort	J.2	273	4,115	4·4	183

TATNELL, W., Gympie (Jersey, 9).						
Golden Vale Beatty	Westbrook Aster's Lad 44th	Mature	273	5,556	4·9	277
Golden Vale Laura 2nd	Westbrook Aster's Lad 44th	Mature	273	4,469	5·9	264
Golden Vale Freda	Westbrook Aster's Lad 44th	Mature	210	3,858	5·5	212
Golden Vale Myrtle	Westbrook Aster's Lad 44th	Mature	273	4,889	5·0	245
Golden Vale Gweneth	Westbrook Aster's Lad 44th	S.3	273	3,176	5·1	163
Golden Vale Dewdrop	Westbrook Valour 19th	J.2	273	3,932	4·9	194
Golden Vale Connie	Westbrook Valour 19th	J.2	273	3,347	4·9	166
Golden Vale Grace	Westbrook Valour 19th	S.2	150	1,884	5·3	101
Golden Vale Lass	Westbrook Valour 30th	J.2	273	4,361	4·8	213
THEUERKAUF, H., Dundas (Jersey, 6).						
Lawn View Dewdrop	Oxford Sam	J.2	273	5,726	4·7	269
Lawn View Bonny	Oxford Sam	J.2	240	6,009	4·6	276
Oxford Royal Colleen	Oxford Royal Ace	J.2	273	5,132	5·0	258
Oxford Lila 3rd	Oxford Noble Winston	J.2	273	5,123	4·8	248
Oxford Valencia	Oxford Franklyn	S.2	273	6,090	5·0	307
Oxford Lass	Oxford Franklyn	S.2	273	6,922	5·1	354
THORNTON, H. A., Kilcoy (Jersey, 4).						
Trinity Golden Marie 2nd	Trinity Crowning Effort	J.2	273	5,929	5·5	332
Bellmore Priscella	Glenview Standard	S.4	273	9,100	4·4	399
Bellmore Merryann	Glenview Standard	J.2	273	6,153	5·2	319
Bellmore Golden Buttercup	Glenview Standard	S.2	210	4,038	4·5	181
TUDOR, W. AND C. E., Gayndah (Jersey, 8).						
Boree Effort's Pandora	Trinity Daffodil's Effort	S.4	273	9,516	5·0	483
Boree Effort's Dainty	Trinity Daffodil's Effort	J.2	273	7,694	5·8	362
Boree Effort's Butterbelle	Trinity Daffodil's Effort	J.2	273	8,311	4·4	367
Boree Effort's Princess	Trinity Daffodil's Effort	J.2	273	7,356	4·7	347
Boree Effort's Prudence	Trinity Daffodil's Effort	J.2	273	8,300	4·5	380
Boree Effort's Beauty	Trinity Daffodil's Effort	J.2	273	7,535	4·6	349
Boree Cute Holly	Trinity Cute Commodore	S.3	273	7,547	5·2	394
Boree Cute Complete	Trinity Cute Commodore	J.2	273	7,872	5·1	405

TABLE 12—*continued.*

RECORDS OF COWS COMPLETING LACTATION RECORDS DURING THE YEAR ENDED 30TH JUNE, 1951.—*continued.*

Cow.	Sire.	Age.	Days Recorded.	Production. Milk.	Test.	Butterfat.
				Lb.	%	Lb.
WACKERLING, M. R., Ravensbourne (Jersey, 1).						
Minidong Snowdrop	Minidong Golden Noble	J.2	273	5,296	5·2	277
WADLEY, D., Indooroopilly (Jersey, 10).						
Oxford Butter Lass	Oxford Franklyn	J.2	273	5,096	5·5	282
Oxford Thora	Oxford King Peter	J.2	273	4,339	5·8	252
Nindethana Valmai	Trinity Valiant Effort	J.2	273	4,278	5·3	230
Trinity Daisy Fern 2nd	Trinity Crowning Effort	Mature	273	7,805	4·8	381
Trinity Prim Girl	Trinity Graceful Lad	J.2	273	5,498	4·2	234
Nindethana Keeper's Countess	Navua Designing Count 2nd	J.2	273	4,000	4·6	183
Trinity National Crescent	Trinity National Victory	Mature	273	6,685	4·2	278
Nindethana Irene	Oxford Remus Victory	J.2	273	5,433	5·1	275
Nindethana Cute Lass	Oxford Remus Victory	J.2	273	5,131	5·3	270
Trinity Cute Lass 2nd	Trinity Cute Effort	S.4	273	6,914	5·5	311
WAITE, H. M., Palmwoods (Jersey, 4).						
Brooklodge Rosette	Trecarne Some Victor 4th	J.2	273	4,209	5·5	231
Brooklodge Noblesse 2nd	Trinity Mighty Prince	J.4	273	5,377	4·9	263
Brooklodge Sepia's Princess	Trinity Mighty Prince	Mature	273	5,470	5·2	285
Brooklodge Cherry Ripe	Trinity Mighty Prince	Mature	273	6,329	5·3	337
WHITE, W. A. AND D., Malanda (Jersey, 7).						
Bellgarth Mariette	Gem Rodney 2nd	J.2	273	5,340	4·9	267
Coraldale Darling's Dream	Peeramon Victor	S.3	273	4,202	3·9	217
Coraldale Gem	Peeramon Aviator	S.3	273	6,866	4·9	339
Coraldale Golden Buttercup	Peeramon Aviator	S.2	273	4,923	5·5	268
Coraldale Day Dawn	Peeramon Aviator	J.2	273	4,384	5·4	235
Coraldale June	Peeramon Aviator	J.2	273	4,153	5·2	216
Peeramon Dawn Ivy	Peeramon Beauty's Premier	Mature	273	6,724	4·9	333

WILTON, J., Killarney (Jersey, 14).

Romsey Stylish Hope	Bellgarth Stylish	Mature	240	5,022	5·6	283
Oxford Brown Maid	Oxford King Peter	J.4	273	4,978	4·9	246
Romsey Bluebell	Romsey Joyful Ruler	J.2	273	4,662	4·8	228
Romsey Fawn	Bellgarth Ruler 4th	S.3	273	6,234	5·6	351
Romsey Ginger Cake	Oxford Flying Fox	J.2	273	5,219	5·8	307
Romsey Brown Lady	Oxford Flying Fox	J.2	120	2,694	5·4	146
Romsey Bonnie Girl	Oxford Flying Fox	J.2	273	4,298	5·5	237
Romsey Ginger Fluff	Oxford Flying Fox	J.2	273	5,318	5·0	266
Romsey Carolyn	Oxford Flying Fox	J.2	120	1,560	6·7	105
Romsey Snow Queen	Oxford Flying Fox	S.3	273	7,603	5·1	385
Romsey Great Hope	Oxford Flying Fox	J.3	273	5,793	5·2	306
Romsey Fancy	Oxford Flying Fox	J.4	273	7,259	5·4	395
Romsey Twinkle	Oxford Flying Fox	J.4	273	7,032	5·8	411
Romsey Buttercup	Oxford Butter Lad	J.2	273	4,123	5·9	243

TABLE 13.
AVERAGE PRODUCTION OF DAUGHTERS OF INDIVIDUAL SIRES.

Sire.	Herd Book No.	Average Production of Daughters in Various Age Groups.												Average of All Recorded Daughters.					
		2 Year Old.			3 Year Old.			4 Year Old.			Mature.								
		No.	Milk.	Butter-fat.	No.	Milk.	Butter-fat.	No.	Milk.	Butter-fat.	No.	Milk.	Butter-fat.	No.	Lac-tat-ions.	Milk.	Test.	Butter-fat.	Maturity Equivalent Butterfat.
			Lb.	Lb.		Lb.	Lb.		Lb.	Lb.		Lb.	Lb.			Lb.	%	Lb.	Lb.
								A.J.S.											
Alfa Vale Nigel	6,439	9	7,176	291	7	7,450	302	2	8,137	307	1	11,674	445	16	19	7,410	3·99	296	378
Alfa Vale Plumber	1,345	3	7,185	294	5	6,917	287	4	8,135	345	6	8,509	336	16	19	7,764	4·09	318	360
Alfa Vale Pride 2nd	5,441	27	7,489	314	8	8,507	362	8	8,062	328	4	11,726	505	38	51	7,817	4·22	330	428
Alfa Vale Pride 3rd	4,515	14	6,398	268	6	6,400	267	3	6,680	300	..	..	..	22	23	6,487	4·21	273	357
Alfa Vale Re-Nell	384	12	6,945	272	10	8,022	317	5	7,693	302	3	10,692	434	24	29	7,495	3·96	297	369
Arolla Limerick	6,474	17	5,649	239	2	6,433	253	..	..	..	..	..	..	19	20	5,731	4·20	241	332
Bingleigh Jean's Monarch ..	6,579	5	8,160	388	6	8,060	412	1	5,962	217	2	13,361	496	10	14	8,874	4·33	384	484
Bingleigh Royal	6,582	3	6,574	268	3	8,321	322	5	7,252	282	1	10,583	448	10	12	7,213	3·91	282	340
Blacklands Count	3,724	17	7,266	293	9	8,624	339	2	10,047	398	3	12,496	512	26	31	8,144	4·01	327	417
Blacklands Czar	3,045	5	6,327	266	4	7,745	315	4	8,930	344	3	9,466	362	15	16	8,021	4·13	331	380
Blacklands Emblem	4,592	11	8,021	332	1	9,797	388	1	6,372	229	1	9,821	365	14	14	8,159	4·05	331	443
Blacklands Jean's Victory ..	5,528	11	7,257	306	2	7,341	296	..	..	..	1	7,920	316	14	14	7,316	4·18	306	410
Blacklands Prospector	37	30	7,743	302	12	8,325	317	1	7,552	324	8	11,302	466	45	54	8,238	3·91	322	416
Burradale Byron	1,258	10	10,161	389	2	14,041	514	1	9,025	367	1	10,980	403	14	14	10,693	3·45	369	540
Corunna Supreme	3,118	19	7,004	275	6	8,620	334	4	9,911	414	6	9,585	396	27	36	7,869	4·08	321	404
Dnalwon Count	2,016	7	6,026	225	3	7,847	282	2	8,342	311	2	8,917	312	13	14	7,095	3·66	260	325
Dnalwon Felix	5,639	8	6,702	236	4	7,836	276	1	8,967	284	2	10,184	367	13	16	7,434	3·59	267	333
Dulcamah Disraeli	3,150	9	5,514	231	1	8,003	326	3	7,281	321	4	8,824	354	13	17	6,501	4·20	273	333
Fairholme Lewis	6,825	10	6,247	284	1	7,233	334	..	..	..	..	..	..	11	11	6,337	4·54	288	398
Fairthorn Rainbows Prince ..	6,834	19	6,576	248	2	7,495	265	..	..	..	..	..	..	20	21	6,482	3·76	244	338
Fairvale Ensign	5,716	1	6,331	254	3	9,606	365	3	10,550	419	5	8,424	330	11	12	8,872	3·88	344	377
Fairvale Jellicoe	8,082	13	7,175	314	1	8,109	403	1	9,563	390	..	..	..	15	16	7,397	4·39	325	432
Fairvale Jeweller	9,324	13	5,804	234	3	6,148	269	..	..	..	..	..	..	14	16	6,150	3·83	236	323
Fairvale Major	4,816	8	7,106	300	6	7,758	311	6	7,519	322	9	9,571	416	23	33	7,960	4·25	338	389
Fairvale Reward	6,837	2	6,307	281	7	6,566	277	6	6,812	292	2	5,301	231	13	17	6,727	4·28	288	342
Glengallen Major	1,551	6	6,848	280	4	6,674	272	2	7,607	319	2	7,557	308	13	14	7,017	4·13	290	359
Glengarry Gems Royal	4,854	2	7,437	320	5	7,342	345	1	6,613	305	17	8,150	389	25	26	7,870	4·73	372	397
Greyleigh Eros	2,193	17	6,878	271	8	9,347	326	6	10,542	398	9	11,979	442	27	45	8,606	3·87	333	406
Greyleigh Honorarium	321	3	8,824	275	1	10,246	370	5	9,911	335	6	10,948	383	12	19	9,903	3·31	328	368
Greyleigh Valiant	666(I.)	5	9,054	341	9	10,408	403	3	10,035	400	3	9,288	359	19	22	9,676	3·88	375	448
Hillview Premier 2nd	1,653(I.)	4	6,797	270	7	7,819	314	1	9,131	343	..	..	..	10	12	7,494	3·98	298	372
Kilburnie Royalist	3,306	8	6,500	265	5	8,404	292	1	7,072	279	1	7,976	321	13	15	7,372	3·80	280	358
Kyabram Masterpiece	7,094	10	6,657	257	2	7,228	282	2	8,493	293	1	10,579	333	12	16	7,056	3·77	266	348
Midget's Sheik of Westbrook ..	1,511(I.)	27	6,972	281	9	8,117	337	1	6,944	319	5	7,853	309	37	45	7,167	4·07	292	368
Mountain Camp Joker	5,979	14	5,336	213	1	6,525	281	..	..	..	..	..	..	14	15	5,388	3·99	215	300
Murry Bridge Florrie's Prince ..	7,210	4	6,671	273	4	7,631	318	5	8,975	336	2	8,201	338	12	15	8,043	3·97	320	375
Navillus Prince Henry	6,013	5	6,480	320	7	7,304	288	6	8,417	336	7	10,248	393	18	26	7,814	3·93	307	356

Newtead Reliance	5,080	10	7,164	309	9	7,600	319	3	9,021	383	1	9,386	357	20	22	7,578	4·24	321	408
North Glen Emblem	2,522	11	7,491	295	7	8,168	338	5	8,979	354	2	14,604	542	17	28	8,077	4·04	326	414
Parkview Highbrow	6,077	6	6,531	266	2	7,946	328	2	7,861	324	1	10,411	382	10	11	7,161	4·07	292	372
Parkview Limerick	5,110	23	6,861	270	6	9,026	366	3	10,759	401	2	9,658	395	27	35	7,495	3·95	296	388
Patrol of Cosey Camp	1,258(T.)	3	7,218	284	2	6,789	256	3	9,076	355	4	9,954	384	11	14	8,559	3·89	333	376
Penrhos Blossom's Prince	2,577	4	8,265	322	3	6,217	265	2	8,569	334	3	8,207	390	11	13	7,634	4·07	311	374
Penrhos Pansy's Pride	4,265	6	9,809	425	10	11,543	500	3	11,307	492	4	13,994	578	21	24	11,364	4·27	485	578
Penrhos Pansy's Prince	3,455	14	6,693	260	8	5,683	238	..	..	..	5	7,894	325	24	29	6,599	4·00	264	337
Reward of Fairfield	1,769	26	9,270	380	18	11,093	464	12	13,077	552	18	14,188	585	44	89	11,197	4·12	461	535
Rocklea Comet	8,627	12	5,803	213	..	..	..	1	4,463	180	..	..	..	12	13	5,807	3·67	213	296
Ronnoc Emblem	7,409	5	7,099	307	4	6,619	271	5	6,441	264	6	8,545	339	20	21	7,272	4·11	299	347
Rosenthal McArthur	8,461	14	6,125	241	5	5,818	231	1	4,080	198	..	..	..	19	20	5,991	3·94	236	324
Rosenthal Musketeer	5,214	9	6,764	267	3	7,269	297	1	11,981	503	3	8,726	362	14	18	7,555	4·06	307	387
Rosenthal Pendant's Prince	564	18	5,655	225	7	6,540	261	5	7,323	288	8	9,553	410	36	38	6,953	4·07	283	340
Rosenthal Perfection	5,216	7	6,525	261	3	7,519	305	4	8,996	336	6	7,975	347	15	21	7,678	3·97	305	357
Rosenthal Surplus 2nd	683	5	5,727	234	9	8,332	334	4	9,682	394	3	9,661	389	15	21	7,795	4·00	312	373
Rosenthal Surprise	5,222	7	5,893	241	3	7,412	304	..	..	..	1	6,643	342	10	11	6,442	4·02	259	343
Sunlit Farm King Billy	4,376	10	6,743	277	1	7,519	298	1	7,402	289	1	9,903	364	13	13	7,097	4·03	286	378
Sunnyview Artist	3,535	19	5,841	242	2	8,024	333	3	7,667	335	1	8,729	389	22	25	6,278	4·19	263	349
Sunnyview Commodore	2,752	6	9,245	372	4	13,045	557	..	..	..	3	9,408	401	13	13	10,452	4·16	435	538
Sunnyview Kitchener	7,488	5	9,920	418	3	8,701	355	1	9,652	366	1	12,572	519	10	10	9,793	4·12	404	522
Sunnyview Royal National	7,493	8	6,890	273	5	7,988	347	4	7,993	331	..	..	..	16	17	7,250	4·11	298	378
Sunnyview Spearvale	8,704	8	7,395	291	7	8,761	337	4	7,771	321	..	..	..	19	19	7,977	3·74	314	395
Tabbagong Victory	8,729	25	6,651	265	3	7,520	312	..	..	..	..	..	..	26	32	6,667	3·99	266	363
Tara Governor	6,297	9	7,046	263	2	9,282	332	1	11,013	378	3	10,570	384	12	15	8,183	3·65	299	379
Trevlac General	2,889	14	6,513	253	5	6,286	297	2	8,692	367	..	..	..	20	21	6,535	4·04	265	350
Trevor Hill Bosca	5,351	27	7,332	299	7	8,307	335	9	8,315	338	6	10,812	443	39	51	7,624	4·04	308	393
Trevor Hill Progress	5,353	11	6,386	264	1	7,494	308	..	..	..	..	..	..	12	13	6,479	4,14	268	374
Trevor Hill Reflection	3,583	16	6,820	290	15	7,500	307	7	9,435	387	7	8,221	363	40	47	7,531	4·21	317	386
Valera Daphne's Pride	7,587	6	4,926	188	2	6,521	237	4	6,308	231	1	6,503	251	11	13	5,514	3·75	207	258
White Park Ronald	3,607	7	5,898	236	3	5,702	236	2	8,770	373	3	9,118	369	11	15	7,053	4·04	285	339
AYRSHIRE.																			
Benbecula Marquis	11,670	9	4,912	197	4	7,078	278	4	8,304	320	2	8,658	340	15	19	6,041	3·95	239	..
Benbecula Bonnie Willie	9,479	4	9,193	347	10	8,385	321	1	6,535	292	3	9,491	351	13	17	8,975	3·84	345	..
Myola Bessemer	11,224	10	5,447	214	6	7,278	282	3	5,949	237	2	8,455	341	16	21	6,103	3·99	244	..
Myola Jellicoe	10,568	15	6,107	249	17	6,647	265	8	7,217	394	9	7,027	283	44	53	6,670	4·05	270	..
GUERNSEY.																			
Fairfield Winner	4,857	9	5,237	245	10	6,291	288	9	6,270	302	4	6,547	302	26	32	6,012	4·69	282	..
Laureldale Pluto	4,211	1	5,928	285	3	6,001	282	3	5,206	272	5	6,567	338	11	14	6,066	4·48	272	..
Laureldale Pride	8,832	25	4,906	226	4	5,158	226	..	..	..	..	..	..	27	29	4,973	4·56	226	..
Linwood Harricane	8,845	14	5,432	250	..	..	..	..	..	..	..	..	..	14	14	5,432	4·60	250	..
Minnamurra Topseys Sequel 2nd	5,095	12	6,400	324	9	6,719	348	4	9,285	435	6	8,618	423	22	31	6,758	5·05	341	..
Warrawong Winter	4,535	16	6,432	306	11	6,428	314	3	7,766	351	2	7,467	349	27	32	6,551	4·82	316	..
JERSEY.																			
Aerofoyle of Banyule	3,181	3	5,794	293	3	6,505	352	2	7,616	402	4	8,516	496	10	12	7,003	5·49	385	431
Austral Park Double Blue	15,633	15	5,522	288	3	7,621	405	1	4,124	249	..	..	..	18	20	5,853	5·23	306	398
Avon Real Star (Imp.)	16,488	11	4,919	262	1	5,167	278	..	..	..	..	..	..	12	13	4,944	5·32	263	350
Belgonia Flashlight	15,354	11	4,688	236	2	4,770	237	..	..	..	..	..	..	13	13	4,701	5·02	236	339
Belgonia Lady Duke	9,513	16	5,580	277	1	5,453	262	3	5,549	293	3	8,170	413	20	23	5,963	5·03	300	374
Belgonia Peggy 9th's Duke	7,429	14	5,114	258	3	6,465	339	1	3,910	207	..	..	..	14	18	5,118	5·10	261	343
Bellgarth Stylish	10,878	13	5,861	328	8	6,081	343	11	6,300	347	12	6,957	391	18	52	6,210	5·55	345	399

TABLE 13—*continued.*

AVERAGE PRODUCTION OF DAUGHTERS OF INDIVIDUAL SIRES—*continued.*

Sire.	Herd Book No.	Average Production of Daughters in Various Age Groups. 2 Year Old. No.	2 Year Old. Milk.	2 Year Old. Butter-fat.	3 Year Old. No.	3 Year Old. Milk.	3 Year Old. Butter-fat.	4 Year Old. No.	4 Year Old. Milk.	4 Year Old. Butter-fat.	Mature. No.	Mature. Milk.	Mature. Butter-fat.	Average of All Recorded Daughters. No.	Lac-tat-ions.	Milk.	Test.	Butter-fat.	Maturity Equivalent Butterfat.
			Lb.	Lb.		Lb.	Lb.		Lb.	Lb.		Lb.	Lb.			Lb.	%	Lb.	Lb.
Belmont Royal Peer	15,243	16	4,189	208	..	..	..	..	..	..	..	..	..	16	16	4,189	4·96	208	281
Brampton Daffodil's Peer ..	11,760	10	4,438	238	1	5,478	303	1	5,878	299	5	6,509	346	12	19	4,910	5·39	265	328
Brooklands Regalia	14,490	13	5,255	286	2	6,169	345	2	6,811	364	..	..	..	14	19	5,473	5·44	298	389
Bulby Maria's Keepsake ..	16,366 (J.S.B.A.)	14	5,868	303	9	5,407	292	5	7,091	398	4	7,580	402	18	32	5,776	5·21	301	371
Bulby Oxford Gamboge ..	12,025 (J.S.B.A.)	5	6,601	336	5	7,578	374	3	7,572	387	2	5,982	299	11	16	6,996	4·92	344	411
Burnlea Aviator 4th	8,317	1	5,105	256	7	5,329	258	3	5,870	287	1	6,589	314	10	12	5,523	4·83	267	304
Calton Lothean	9,615	6	6,547	320	4	7,187	377	4	7,328	365	5	7,898	395	13	19	7,177	4·97	357	414
Devon Park Maderias Victorious	15,744	26	5,405	315	3	6,063	431	..	..	..	..	..	..	29	29	5,542	5·90	327	433
Glenside Lone Star	9,721	5	6,131	312	1	6,579	327	1	7,860	451	8	8,466	392	12	15	7,338	4·93	362	408
Glenview Royal Chief	13,956	12	4,941	241	3	5,697	301	5	6,825	348	..	..	..	17	20	5,365	5·03	270	335
Hunstrete Emperor's Volunteer (Imp.)	6,457	..	..	..	..	..	..	..	..	..	11	7,955	455	11	13	7,955	5·72	455	455
Lermont Volunteer	8,658	15	4,077	211	3	5,108	283	3	5,794	353	1	4,954	249	18	24	4,315	5·40	233	294
Jersey Lea Golden Duke ..	13,831 (J.S.B.A.)	20	4,793	267	14	5,455	316	5	5,903	315	14	6,016	324	27	63	5,192	5·60	291	337
Masterpiece Yerribee of Bruceville	3,292	7	5,299	277	5	5,728	305	4	6,428	344	8	7,793	426	17	25	6,491	5·28	343	382
Maurfield Larkspur's Gift ..	9,632	9	6,195	330	5	7,579	377	1	6,942	349	8	8,192	405	16	23	7,207	5·06	365	427
Mornmoot Clementine's Valour..	12,092	8	6,414	307	4	5,977	288	3	6,913	347	2	9,373	488	16	17	6,643	4·88	324	388
Navua Ladoras Ruler	10,249	6	5,880	349	4	6,472	373	6	5,687	363	4	5,975	335	18	20	6,097	5·95	363	421
Navua Victorious Samaritan ..	13,167	6	4,591	244	5	4,842	265	3	5,801	314	1	6,553	353	12	15	4,960	5·36	266	321
Oxford Ajax	11,553	7	6,243	312	3	6,524	351	..	..	..	2	7,550	432	10	12	6,354	5·19	330	410
Oxford Aster's Lad	8,129	5	4,927	301	5	7,537	354	2	6,496	314	7	7,275	360	18	19	6,612	5·13	339	384
Oxford Brown Victory	6,162	8	5,650	290	2	5,022	292	2	5,495	339	4	4,657	244	13	17	5,154	5·29	273	330
Oxford Daffodil's Victor ..	11,016	10	6,188	347	4	8,141	467	2	8,539	459	5	6,386	399	20	21	6,668	5·74	383	409
Oxford Fawn's Noble	14,530	15	5,775	321	4	6,633	375	4	5,733	321	..	..	..	16	23	6,015	5·50	331	428
Oxford Fawn's Victor	12,605	13	5,321	276	3	4,927	313	1	6,669	364	1	6,669	364	16	22	5,313	5·14	273	345
Oxford Flying Fox	15,501	8	4,634	243	3	5,363	279	2	7,146	403	..	..	..	11	13	5,204	5·32	277	343
Oxford Franklyn	16,005	12	5,926	293	1	5,808	300	..	..	..	..	..	..	13	13	5,916	4·95	293	391
Oxford King Peter	15,273	9	4,768	259	1	3,651	177	1	4,978	246	..	..	..	10	11	4,635	5·33	247	332
Oxford Noble Peer	9,124	8	4,912	282	4	5,709	330	1	7,321	436	4	6,701	377	11	17	5,327	5·65	301	369
Oxford Peer	7,361	16	5,717	313	4	6,167	332	..	..	..	1	7,315	385	19	22	5,829	5·51	321	420
Oxford Pixie's Victor	10,837	16	5,422	287	3	5,941	302	3	6,637	336	2	6,625	312	19	25	5,542	5·20	288	370
Oxford Royal Lad	8,001	27	5,888	315	8	6,849	362	7	7,341	389	2	7,209	338	37	44	6,106	5·26	321	399
Retford Earl Victor	3,655	11	7,349	380	3	6,931	392	6	7,261	374	8	8,101	392	18	29	7,205	5·14	370	430
Retford King's Thorn	5,115	12	6,170	325	5	7,286	411	3	8,319	464	8	8,168	449	26	28	7,246	5·44	394	455
Retford May's Victor	5,286	8	6,141	336	2	6,051	345	2	8,373	503	6	7,745	411	12	21	6,682	5·31	355	418
Retford Royal Atavist	7,066 (J.S.B.A.)	28	4,607	254	2	5,377	307	1	10,115	590	9	8,927	492	37	41	5,614	5·54	311	377

Rosel Solid Gold	11,813	1	5,525	309	3	4,169	234	7	4,584	262	5	6,261	314	16	17	5,089	5·42	276	282
Samares Cute Prince 3rd ..	8,876	8	6,423	345	3	8,615	427	3	8,134	416	3	7,657	416	13	17	7,023	5·24	368	437
Selsey's Royal Standard ..	12,093	3	6,117	332	7	6,040	312	2	5,579	291	3	7,032	329	12	15	6,195	5·18	321	369
Selsey's Samares Hallmark ..	11,722	26	5,419	288	2	6,320	363	1	7,462	404	2	6,298	364	26	32	5,423	5·38	292	384
Trecarne Butter Queen's Officer	10,218	9	4,263	239	2	5,377	311	2	4,852	270	4	5,307	298	10	19	4,508	5·61	253	311
Trecarne Golden King 2nd ..	11,233	13	5,422	335	4	6,641	404	2	6,136	400	1	7,699	474	17	23	5,751	6·17	355	442
Trecarne Renown 2nd	5,546	23	4,947	264	9	6,639	357	4	6,546	343	2	6,775	360	27	40	5,325	5·46	291	362
Trecarne Royal Officer	12,999	17	3,770	212	3	5,074	290	1	6,528	315	..	..	..	18	22	3,974	5·53	220	288
Trecarne Some Duke	11,850	21	4,962	265	15	5,681	303	10	6,062	316	10	6,276	345	35	60	5,608	5·33	299	355
Trecarne Some Tot's Duke 2nd..	14,241	13	4,926	267	3	5,407	292	1	7,061	379	..	..	..	13	21	4,889	5·46	267	346
Trecarne Victor 4th	11,492	26	4,986	253	11	6,073	307	9	6,293	328	4	7,275	376	30	57	5,713	4·74	271	336
Trinity Ambassador	2,834	15	5,793	325	8	7,169	428	5	6,546	367	6	6,903	375	24	38	6,058	5·56	337	403
Trinity Crowning Effort (Imp.)..	12,311	22	5,191	272	6	7,739	411	5	8,452	432	8	7,659	385	30	44	6,142	5·18	318	381
Trinity Cute Commodore ..	11,101	8	7,490	369	7	7,735	391	3	8,013	394	3	6,881	345	19	21	7,589	4·97	377	462
Trinity Daffodlil's Effort ..	13,747	21	6,665	315	2	8,638	422	3	8,386	402	..	..	..	22	26	6,868	4·73	325	425
Trinity Graceful Duke	14,575	17	4,735	257	2	5,319	308	..	..	..	..	..	..	17	21	4,830	5·48	265	350
Trinity Governor's Hope ..	5,730	42	5,684	292	19	7,537	382	6	7,357	398	18	8,189	417	55	90	6,334	5·13	325	395
Trinity Golden Royal	10,760	16	5,024	271	7	6,150	337	3	6,460	347	7	6,294	347	24	37	5,710	5·44	311	375
Trinity Mighty Prince	13,674	8	5,551	310	2	6,212	323	3	6,319	323	2	5,900	311	13	15	5,838	5·27	308	375
Trinity National Victory ..	12,309	9	5,261	282	5	6,822	348	1	8,263	390	1	7,051	313	16	17	6,292	4·94	311	386
Trinity Noble Effort 2nd ..	13,323	23	4,478	245	6	5,660	308	3	6,033	367	..	..	..	24	33	4,780	5·38	257	345
Trinity Popcorn 2nd's Pioneer ..	6,952	4	5,814	299	1	5,503	343	4	5,564	280	2	6,765	347	10	11	5,770	5·16	298	345
Trinity Royal Prince	10,756	6	5,251	259	4	5,999	304	1	5,172	263	1	6,567	349	12	12	5,603	5·03	282	343
Trinity Royal Sovereign ..	8,180	7	5,587	276	2	6,238	299	1	4,073	238	5	6,751	348	15	16	5,961	5·00	298	354
Trinity Some Officer	6,798	7	5,428	314	9	6,666	390	8	7,443	439	12	6,625	379	21	46	6,403	5·79	371	410
Vinchelez Golden Victory (Imp.)	4,943	14	4,395	256	6	5,025	304	..	..	..	4	5,311	283	18	26	4,747	5·69	270	336
Westbrook Aster's Lad 39th ..	11,654	4	4,077	216	6	4,891	250	..	..	..	..	..	..	10	10	4,565	5·17	236	295
Westbrook Aster's Lad 44th ..	11,865	1	2,396	98	1	3,176	163	4	4,288	212	9	4,347	226	20	20	4,179	5·12	214	219
Wheatlands Jester (Imp.) ..	6,950	2	5,544	268	3	7,364	387	1	10,379	615	7	7,526	411	11	13	7,077	5·28	374	403
	(J.S.B.A.)																		
Woodside Golden Volunteer ..	6,366	58	5,118	269	16	6,335	337	6	6,346	344	9	7,183	383	66	99	5,407	5·25	284	363
Woodview Officer	14,025	12	3,765	205	2	5,604	309	..	..	..	..	..	..	12	14	4,015	5·38	216	290

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